The Chemical Age

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The Ammonia Industry

HALF the world's fertiliser consumption consists of ammonia salts, and the consumption of these salts is increasing rapidly. It is a pity that the date of issue of the report of the British Sulphate of Ammonia Federation, which was recently summarised in our columns, is so chosen that publication on the threshold of 1937 is no more up-to-date than to give the production for 1935. The 1930 to 1935 figures show that whilst world production is increasing, British production is not. The total of ammonia products manufactured in this country, expressed as equivalent sulphate, has fallen from 804,114 tons in 1930 to 610,000 tons in 1934, with a trifling increase to 612,549 tons in 1935. In the same period the direct sulphate production has decreased from 678,400 tons in 1930 to 448,500 tons in 1934, with a still further decrease to 448,000 tons in 1935.

Synthetic production is so recent that a text-book written in 1915 prophesies that "in the course of a few years large amounts of synthetic ammonia will be on the market." By 1924, this country was making some 250 tons of synthetic ammonia per day at Billingham, which amounts to about one-fifth of our present ammonia production. To-day the world capacity of synthetic ammonia plant is such that in spite of a world increase in ammonia consumption of about 16 per cent. in 1935, the synthetic plants only operated at 48 per cent. capacity. Such facts have caused the synthetic product to dominate by-product ammonia, so that coke ovens and gasworks have been recovering as little ammonia as possible and have even been studying ways of destroying ammonia in the retort.

The non-success of by-product ammonia production was ascribed by Mr. P. Parrish at the meeting of the Institution of Gas Engineers in the late autumn to the smallness of the gasworks and Mr. Parrish maintained that "the only way in which that situation can be met is by converting the gas liquor which is formed at the smaller and medium sized works, and indeed at some of the larger works, into a product of higher concentration—concentrated gas liquor." Concentrated liquor is being made to-day to the extent of 45,000 tons annually; ammonia from coal to the extent of 1,750,000 tons carbonised at coke ovens and from 2,250,000 tons carbonised at gasworks is being made into concentrated liquor, *i.e.*, some 12 per cent. of all the ammonia made in carbonisation works is being converted into gas liquor so that coke ovens are following gasworks in going over to the indirect process of ammonia recovery. Mr. Parrish, having these facts in mind, says: "Works are operating to-day which are dealing with 10,000 tons of concentrated gas liquor per year, and the price at which sulphate of ammonia is being manufactured under these conditions is such that a very satisfactory profit can be made. My own company (South Metropolitan Gas Co.) has developed this question of concentrated gas liquor to such an extent that we have sufficient hydrogen sulphide released to justify an independent unit of plant for the manufacture of sulphuric acid . . . and we are making sulphuric acid at an incredibly low cost."

Whilst the tendency of coke ovens is no longer to throw ammonia away by making use of old pi shafts and the like for the disposal of liquor, there is still insufficient profit in sulphate to make it attractive. Plants for the production of sulphate are still being built, but it may well be suggested in view of Mr. Parrish's statement that the chemical industry should step in to take a hand in the game. It is not beyond the bounds of possibility that an enterprising chemical manufacturer might arrange with a group of by-product coke ovens and gasworks concentrated in a sufficiently circumscribed area to take all the concentrated liquor produced and to work it up on a communal basis.

An arrangement of this character has been made in the past in respect of tar, and with very great success. It would be quite simple for the carbonisation works to replace their present sulphate plant, as many did during the war, by a concentrated liquor plant, in which they would use methods that would retain as much sulphuretted hydrogen within the liquor as possible. This sulphuretted hydrogen could be worked up into sulphuric acid in the central works, as Mr. Parrish says, at an incredibly low cost and sulphate of ammonia would once again prove to be a paying proposition.

The colliery companies and gas undertakings might contribute towards the capital cost of the plant and receive an agreed price per unit for ammonia delivered to the central works, with a proportion of annual profits based on their share of the capital cost and on the quantity of ammonia sent to be worked up. There is the added advantage that the central works would not be restricted to the production of sulphate as would a carbonisation works, but could turn to the manufacture of other ammonia or nitrogenous compounds in considerable variety. Industry requires many nitrogenous compounds—explosives, ammonia and its many salts, nitric acid and the nitrates with a large range of organic nitrogen compounds. What, for example, is to stop the central refining of benzole at the same works with the production of dystuffs intermediates from nitric and sulphuric acids derived from the concentrated ammonia liquor?

Notes and Comments

Representatives

"TRAVELLERS can be seen on Thursdays only at 12 noon." If you *must* exhibit such a notice, by all means do so. No one will be offended, and certainly no enterprising representative will avoid appearance in due course, at the appointed time when you sit in state to receive the ambassadors of industry and commerce. But, in the absence of such a practice, please do not look upon the representative as nuisance No. 1. The men "on the road" are entitled to a courteous reception; it may be very short— a matter of half a minute, perhaps—but, at the least, courteous. If you—as principal or as a departmental manager—happen to be otherwise engaged and cannot possibly see the caller, there is surely someone other than the office boy who has a good knowledge of your business needs and sufficient firmness to deputise for you, to give intelligent ear to the caller for the space of two or three minutes. If occasion justifies it, be firm in avoiding a needless waste of time, for there are representatives who "prattle for the sake of prattling." Take any literature which is proffered; it incurs no obligation, other than a pleasant remark that you will peruse it at leisure. Receive it as a gift, and not as a quick and ready means for terminating the interview. The good man "on the road" has no more desire to waste his time than you have of wasting your time. A subsequent call may be fruitful to him in gaining a longer interview, with some definite query for him to answer; alternatively, it may convince him that he is unable to serve you at the immediate moment—or that you are a very clever fellow who has nothing to learn and therefore easily able to miss the good experience of adventure among untried gadgets and products.

Overseas Trade in 1936

IF the chemical industry of this country depended mainly upon its overseas markets it would have cause to view the latest Board of Trade returns with apprehension. There is good ground for believing, however, that export trade is, at the present time, of less importance to the industry than the home market, but the narrowing of the margin between exports and imports in 1936 is not a matter that can be regarded with indifference. For the first time for several years, exports of chemicals, drugs, dyes and colours in the twelve months just ended showed a decrease, amounting to some 10.8 per cent., though still leaving the total well above the 1934 figures. Chemical imports during the year showed a further rise of 8.4 per cent. over the 1935 total. Not many years ago exports represented just about double the value of imports, but the margin between the two totals has been appreciably reduced, the 1936 import figures representing just under 69 per cent. of the value of exports. Re-exports during the year were valued at £403,676, an increase of £2,975 over 1935, but a decrease of £270,570 on 1934, an abnormal year from the point of view of the export of imported products. The new year has opened with a hopeful outlook, and we shall look for a reflection of that optimism in a gradual improvement in the export figures during the coming months.

Our Best Customers

INDIA was again the largest purchaser of British chemical products last year, taking a total of £2,530,962 in value, against £2,881,814 in the previous year. Next in order of value was Australia, which took £1,885,162 worth of chemicals against £1,770,314 in 1935. South Africa increased her purchases from £1,438,679 to £1,568,954, and Canada also took £1,235,750 against £1,195,872. Of foreign countries, the United States headed the list of our best customers with purchases of chemical products to the value of £1,024,537, a welcome increase of £324,368 over the total of the previous year. Germany's total of £301,941 was £40,938 up on the previous year. Details of chemical products indicate that the principal changes in exports were due to decreased demands overseas for ammonium compounds, copper sulphate, disinfectants, sodium compounds and painters' materials. Consignments of sulphate of ammonia to Java faded away from over £22,000 to nil; Portugal from £155,616 to £34,676; and Japan from £28,539 to £1,003; in fact every purchasing country shown separately in the returns registered a decrease under this heading. On the other side of the account, Great Britain imported more acids, dyestuffs, potassium compounds, drugs and medicines than in 1935. Dyestuffs imports from Germany alone rose from £728,907 to £931,091, whilst the total dyes and dyestuffs imported from all sources during the year rose from £1,186,294 to £1,458,228—a sure index of prosperity in some of the kindred industries.

A Better Understanding

OPPORTUNITIES are too often taken for the industrialist and the scientist to throw stones at one another, but we have been glad to detect in a number of papers presented at recent meetings a praisworthy effort to bring what are erroneously regarded in some quarters as conflicting interests into harmony with each other. The lecture which Mr. H. W. Cremer, who, we regret to learn, has been compelled by pressure of other work to resign the hon. secretaryship of the Institution of Chemical Engineers, delivered at Liverpool the other day was a noteworthy example. The conclusion to be drawn from his lecture is that despite individual differences, science and industry in the abstract are bosom companions. There are, it is true, some industrialists who complain that the chemist is not "dividend-minded," and there are chemists who reply that they should not be expected to produce gold bricks at stated intervals, especially without straw, and that the chemical industry provides many illuminating examples of profitable side lines, even major undertakings, which have arisen from fortuitous discoveries in the laboratory. The cautious chemist who waits to analyse what the industrialist, sometimes impatiently, wants to do is liable to be written down as unpractical, whereas his sole idea is to investigate the fundamental problems involved and save the industrialist from failure. The more the two interests can be persuaded to see each other's point of view the better it will be for the common good.

Superphosphate: Its History and Manufacture*

By WALTER G. T. PACKARD

IT now seems to be definitely established that a German named Escher, in 1835, first suggested that finely ground bone meal when digested with acid had a greater effect on plants than untreated bone meal. He advised farmers to try experiments, but did not experiment himself, and died within a year of publishing his idea. In 1839-40, Liebig, who apparently knew nothing of Escher's discovery, published in French a report on agricultural chemistry, in which he stated that good results could be obtained by treating growing plants with bone meal which had been treated with sulphuric acid.

In the very early days of the industry the phosphate and acid were mixed on a brick floor like mortar, or the acid was run into a brick lined pit, the finely ground phosphate being thrown into the acid and the mass agitated by men standing round with rakes, a very unpleasant job. Mr. Thomas Brown, the founder of the West Norfolk Farmers Co., commenced business by undertaking to make superphosphate in the barns of large farmers. He bought the phosphate and acid for them, and superintended the mixing by the farm hands. So great a reputation did he acquire that he had no difficulty in persuading a group of farmers to build their own works, which is running to-day and is one of the largest works in this country.

From the mixing pit, the den was evolved. This was a square or rectangular chamber lined with brick with a top inlet through which the semi-liquid mass was dropped from a small mixer. The dens usually held from 30 to 50 tons of superphosphate, but the author has seen dens which held 100 tons and more.

With the introduction of the den, the mixing was improved. The mechanical mixers were of various types; vertical or horizontal, with arms or beaters agitating the mixture of acid and phosphate. One horizontal mixer consisted of an inclined wooden trough lined with lead, having revolving stirrers, and sealed with a heavy door. The acid was measured in a calibrated lead tank connected to the mixer by a lead pipe closed by a plug. When the correct quantity of acid was ready, a weighed quantity of phosphate was placed in the mixer and the acid admitted. Before the mixture began to grow sticky, the door was lifted and the batch released into the den.

In the early years of the twentieth century, an average superphosphate contained moisture varying from 13 to 18 per cent., and free acid from 4 to 8 per cent. With as much as 15 or 16 per cent. of moisture present on leaving the den, it was difficult to get a superphosphate into dry friable condition for sowing on the land, but it could be done and after leaving it for at least a month in the heap and using a disintegrator and screen which did not paste the material.

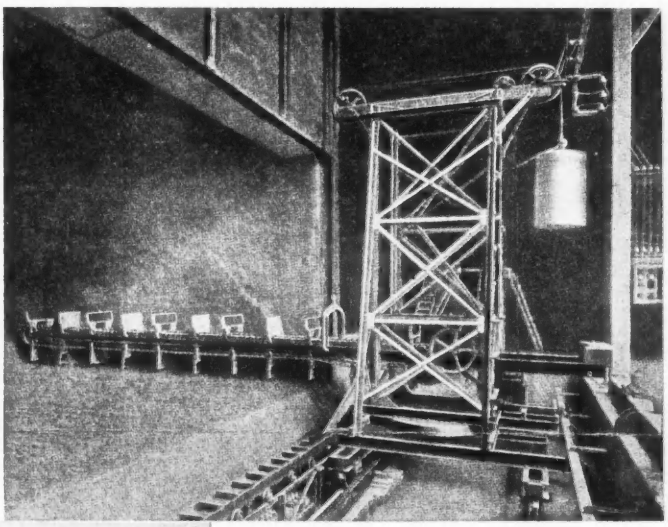


Fig. 1—Keller Den.

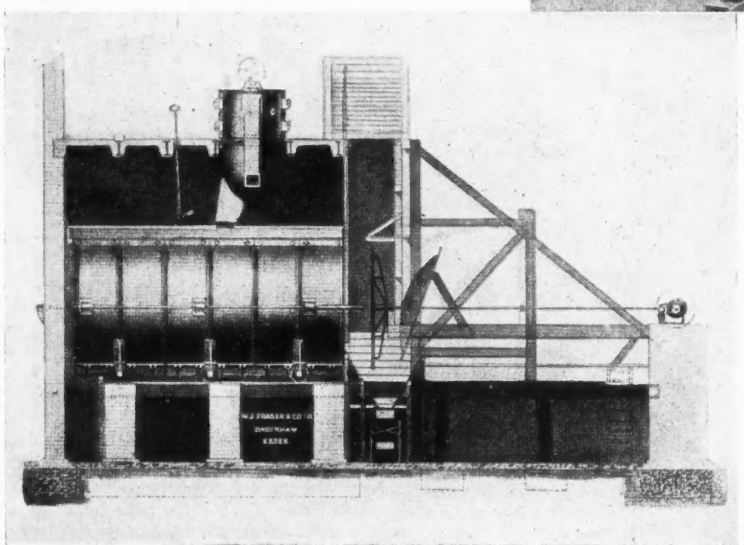


Fig. 2—Milch Den.

The beginning of the mechanisation of the superphosphate industry was about 1910, and it has been continued until, at present, in a modern factory there is not a shovel or a barrow used from the time the phosphate enters until the superphosphate leaves the works.

The first mechanical den used in this (1910) was the Keller (Fig. 1); Milch, Wenk, Svenska, Sturtevant, and others all followed quickly. With the exception of the Sturtevant, all were of Continental design.

The Keller was really an excavator which could be inserted into an existing den, whereas the others comprised the whole of the plant, and was first installed in the works of the Anglo-Continental Co. It consists of a strong framework supporting a horizontal arm carrying a set of travelling scrapers which pull the superphosphate to the mouth of the den. The framework travels on rails from one side of the den to the other, and the arm takes a layer from the surface of the superphosphate as it goes. As the level is lowered, the arm drops. The objection to this type is that anything which scrapes the superphosphate tends to convert it to a paste.

The Milch den (Fig. 2) found considerable favour in this country. It consists of a steel cylinder, mounted on wheels, and propelled forward towards a revolving knife by screws attached to each side of the cylinder. There is a hinged opening along the bottom of the den, and the superphosphate as

* From a paper read at a meeting of the Institution of Chemical Engineers, held in London, on January 20.

it is cut out by the knife, drops through this opening on to a conveyor which takes it away. When the den is empty, the screws are reversed, and the den travels back to the charging position. This den holds about 30 tons of superphosphate and takes half an hour to discharge.

The Svenska den (Fig. 3), which came from Sweden, consists of a rectangular brick chamber closed at the back by a steel plate attached to four screws, and in the front by a steel plate supported from above by a chain. In front of this plate horizontal shafts held by endless chains on either side of the den travel at an angle down the surface of the den. On these shafts are fixed discs with fingers on them which crumble the superphosphate on to a conveyor band underneath. The superphosphate is mixed at the top of the den, and after about 20 minutes the front plate can be raised. The screws at the back of the rear plate are then rotated, and the block of superphosphate, from 20 to 40 tons, is pushed towards the crumbler and the den emptied in from 20 to 40 minutes.

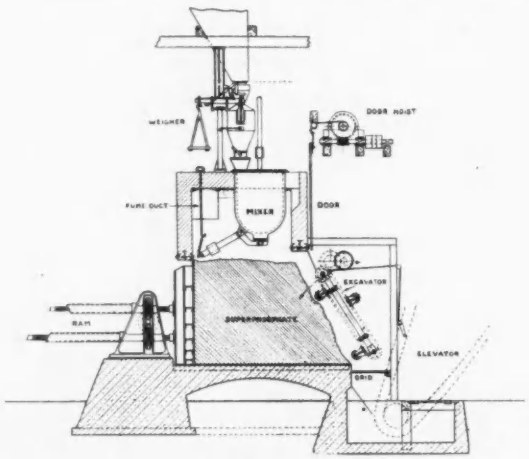


Fig. 3.—Svenska Den.

The Svenska den was generally used in conjunction with a Lütjen slicer and silos. The slicer consisted of knives revolving horizontally at a high speed, and after leaving the knives the superphosphate passed into a large wooden silo, ventilated by a fan, to remove as much moisture as possible. After 12 hours the superphosphate was removed to the store pile. It was thought that the superphosphate would remain in the heap in a fine state of division, and need no more disintegration, but in practice there is always caking in the heap.

The Forbis Revolving Den

In the Forbis revolving den (Fig. 4), seen in America in 1920, the superphosphate was not touched until 8 hours after mixing. This den is mounted on a gigantic turntable and consists of the space between two circular walls of concrete sealed at the top by a fixed platform, on which the mixer is mounted. The excavator, which is an elevator with scrapers attached, is also fixed, and the superphosphate travels round the circle from the mixer to the elevator in eight hours. The whole idea is ingenious, and illustrates the divergence of ideas between 15 minutes and eight hours, but the author was not convinced that the superphosphate was any better for its eight hour rest, but rather that, with the den product, the material should be excavated as soon as solid, so as to get rid of the moisture whilst it is hot.

Recently a new type, the Maxwell continuous den (Fig. 5) somewhat on the principle of the Forbis den, but revolving in a vertical plane instead of horizontally, has been developed, resembling a gigantic pneumatic tyre. The den is made of cast steel in sections bolted together having an external dia. of 19 ft. and a cross-sectional dia. of 5 ft. 6 in., and is supported on either side by cast-steel treads which rest on four rollers. The whole structure is rotated by a worm gear which engages with a toothed ring completely encircling the circumference at the rate of 1 rev. in 4 hours. The semi-liquid mixture of acid and phosphate enters the den, which is really a trough open at the centre, at a point on the downward side just above the lowest point. The trough revolves so slowly that the superphosphate solidifies before it reaches a position at which it would run back to the bottom.

A very important part of the Maxwell den is the mixing device, which is continuous and automatically controlled, ensuring a regular supply of acid and phosphate to the mixer. The phosphate is measured by a series of pockets set in a rotating disc, the speed of rotation being controlled by a chain drive connected with a sulphuric acid feeder formed of four scoops also on a revolving disc which dip into a small tank in which the acid is kept at a constant level. Once the correct proportions of acid and phosphate have been determined, they are maintained by this mechanism, which is said to require litte attention.

The time the superphosphate remains in the Maxwell den is about 2½ hours, and the output from a den of standard size is about 5 tons per hour.

Development in the United States

In America the development was along somewhat different lines from those adopted in this country; the principal reason being that the units used were much larger than in this country and so the problem became one of handling in bulk large quantities of material. An average factory in America has a capacity of 100,000 tons per annum compared with about 20,000 in this country, whilst a factory like that of the Davison Chemical Co. can produce 500,000 tons per annum.

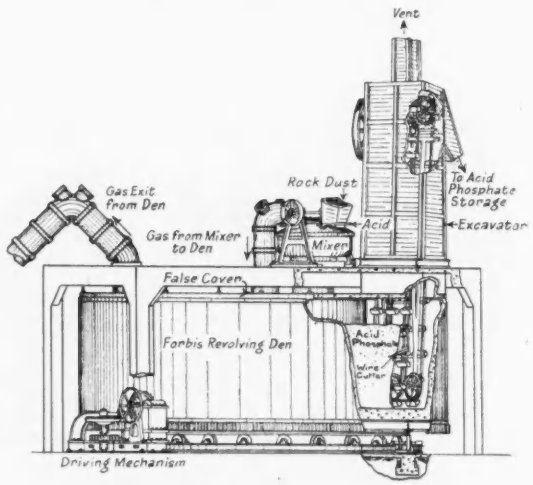


Fig. 4—Forbis Den.

In 1920, the mechanical den was only used in the smaller works. The larger works either used a mechanical shovel working into an old-type den, or an overhead grab crane working into a den either rectangular or in the shape of a vertical cylinder. At the works of the Davison Chemical Co. there is a battery of such dens each having a capacity of 100 tons, and the mixing platform containing the acid and phosphate measuring and mixing equipment travels on rails from one to the other. The dens are at one end of a huge storage shed and the grab, which is known as an orange-peel bucket, is lowered into the den from the overhead crane, which raises the full bucket and drops its load on to the pile of superphosphate. When the superphosphate is conditioned, it is lifted by an overhead crane and dropped either into a hopper from which it is drawn off and conveyed to the disintegrating and bagging machines, or into trucks in bulk for conveyance to the compound mixing plant.

All the dens described produce superphosphate with a moisture content varying from 12 to 16 per cent., and a free acid

content estimated by the acetone method of from 4 to 6 per cent. The following table gives some typical examples:

Super-phosphate	Sol. $=Ca_3P_2O_8$. P_2O_5.	Insol. $=Ca_3P_2O_8$. P_2O_5.	Moisture	Free Acid
30%	13·78 = 30·11	0·76 = 1·67	16·70	3·85
33%	15·11 = 33·04	0·90 = 1·95	15·88	3·74
35%	16·13 = 35·27	0·64 = 1·39	15·50	4·17

A product of this kind is bound to form a paste or ball when put through mechanical disintegrators, and although by conditioning in the store shed another 1 or 2 per cent. of moisture is removed, manufacturers have been continually striving, with a good deal of success, to find machines which will produce a friable superphosphate, but it has been a difficult task and always an anxiety for the works manager. The slicer type of machine, combined with a shaker screen, is the most successful.

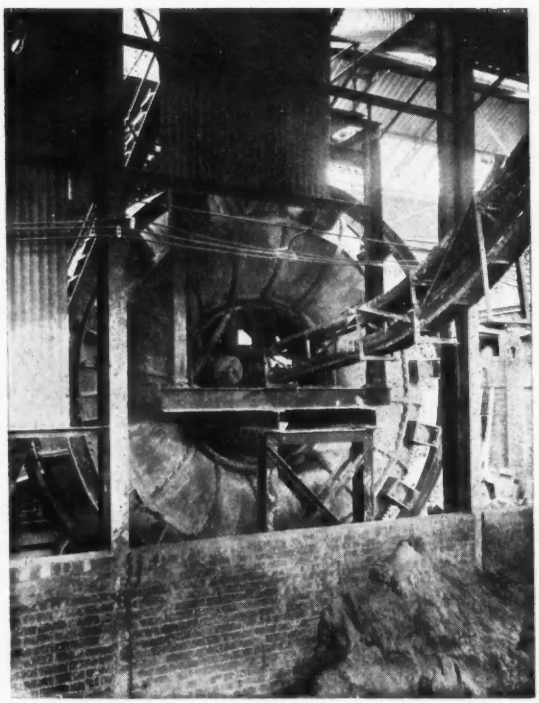


Fig. 5—Maxwell Den.

The recent developments are in drying the superphosphate and in producing a dry superphosphate by new processes of mixing. The secret of drying superphosphate is temperature control. The Sturtevant standard dryer (Fig. 6) will reduce the moisture in a superphosphate from 15 to 4 per cent., and dry 6 tons per hour. When dried until it contains only 4 per cent. moisture, the superphosphate contains 2 per cent. more P_2O_5 than when it entered the dryer, and, of course, is much more easy to handle than the undried material. Dried superphosphate, however, has not completely solved the problem of setting when mixed with other fertilising ingredients to form compound fertilisers.

Manufacture of Dry Superphosphate

During the last few years several processes have been evolved, particularly on the continent and in America, for the direct manufacture of a comparatively dry superphosphate in which the moisture is reduced from 15 per cent. to 11 per cent. or 12 per cent. In these processes the appearance of the material and its inherent qualities do not differ much from those of the material produced by the older mechanical dens.

The superphosphate runs more freely, of course, and is more finely divided, but there is still a tendency to form a paste when rubbed.

The Broadfield process, evolved in the works of the Georgia Fertiliser Co. of America, has found general favour in England and on the Continent, five or six factories having adopted it in England. It is a continuous process, but while the standard unit produces 10 tons per hour, it can be stopped and started at will, and lends itself to intermittent working. A

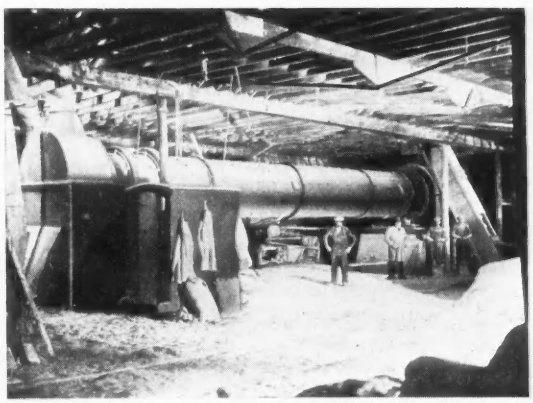


Fig. 6—Sturtevant Den.

stronger acid is used in this process than is usual with other dens, the usual strength used being about 127° Tw., and the fineness of the phosphate dust varies from 87 to 90 per cent. through 100-mesh sieve.

Another continuous mixing process which produces dry

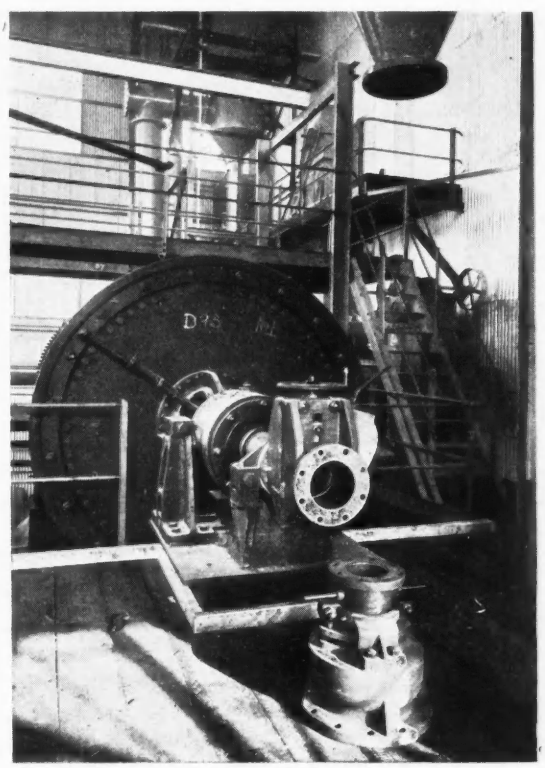


Fig. 7—Autoclave.

superphosphate has been perfected by Mr. Sven Nordengren at one of the factories of the large Swedish superphosphate organisation. This process differs from any other method in that the mixing is carried out in two stages, and in two separate mixers. Into the first of these two mixers the whole quantity of acid of 60° B = 142° Tw. required to dissolve a given quantity of phosphate is placed, but only a portion of

that phosphate. In the first stage the object is to retain the mixture in a condition of sludge until the maximum quantity of the phosphate is in the form of phosphoric acid. The sludge, when thoroughly mixed, is run into the second mixer and the remainder of the phosphate added. The patentee of this process regards the accurate weighing of the phosphate, as opposed to measurement in similar processes, as of paramount importance in order to secure regularity of product. The plant is very compact, and an output of 40 tons per hour can be obtained in a floor space of 18 by 6 metres.

The Moritz-Standert process appears to be very similar to the Broadfield, except in the construction of the den. Like the Broadfield, it turns out a product containing only from 10 to 11 per cent. of moisture without additional drying. The process is continuous, and the capacity of a unit varies from 12 to 25 tons per hour. Again, like the Broadfield, acid of rather higher strength is used than with the old den process; a strength of 55° B = 123° Tw. is necessary to ensure a dry superphosphate, and the phosphate is ground so that 90 per cent. to 95 per cent. will pass through a Kahl. E. sieve.

The Oberphos Process

The Oberphos process stands by itself in that it makes a dry, gritty material which can be ground in a mill, and thus differs from all other processes. It was evolved in the works of G. Ober and Sons, of Baltimore, U.S.A., as the result of costly and exhaustive experiments and research spread over a number of years. Unlike the Broadfield, Moritz-Standaert and the Nordengren processes, the Ober process uses acid of the same strength as the old den process, namely, 115 to 120° Tw., but with this process the temperature of the acid entering the autoclave is most important and should range from 90 to 105° F.

In this process there is no actual mixer in which the phosphate and acid are puddled or kneaded before solidifying. The phosphate dust, which is ground to 80 per cent. through a 100-mesh sieve with North African phosphate and 85 per cent. with Morocco or Florida, is conveyed to a hopper of sufficient size to hold a charge of approximately 8,000 lb. and the acid weighed in an automatically controlled tank is run into a cast-iron container or egg homogeneously coated with lead. Simultaneously, the acid and phosphate are forced by compressed air through a specially constructed valve which imparts a spiral movement to the mixture and into a steam-jacketed autoclave (Fig. 7) which is under vacuum and rotating. The entry of the phosphate and acid, about 8 tons in all, into the autoclave takes about 90 secs. and as soon as it is completed, a valve at the opposite end of the autoclave is closed, and the heat of reaction causes the pressure inside the vessel to rise.

Operation of the Autoclave

By means of a blow-off valve the pressure is maintained at from 80 to 90 lb. per sq. in., and at the end of 30 or 40 minutes, according to the phosphate used, the reaction is complete. The autoclave is then again put under vacuum for another half-hour while the gases and moisture are exhausted, the gases being absorbed by a large volume of water passing down absorption towers. By means of the steam jacket, the autoclave is kept at a constant temperature. In this manner not only is the violence of the reaction increased, but the superphosphate is rapidly dried. When the requisite degree of moisture is obtained, the autoclave is stopped and the manhole cover removed, after which the autoclave is rotated again and the material drops out into a hopper from which it is conveyed on a rubber band to the store shed.

With as much as 10 or 11 per cent. of moisture present, it is possible to grind Oberphos, or granular super as it is called, to almost any degree of fineness, and it can be screened through a vibro-electric screen of the Hummer type of $\frac{1}{8}$-in. mesh.

The Oberphos process entails expensive plant: the steam jacketed autoclaves homogeneously coated with lead each weigh over 40 tons, and the control valves are made of acid-resisting metal and are expensive. Neither is the process a simple one, but the same men can operate it who have been working on the old den process, and the degree of control is greater than with any other process.

Fishing Industry By-Products

Varied Industrial Uses

MR. J. A. LOVERN, of the Torry Food Investigation Research Station, read a paper on "By-Products of the Fishing Industry at a recent meeting of the Newcastle Section of the Society of Chemical Industry. One of the most important by-products of the fishing industry, he said, is fish meal, which is made from the waste of the curing and filleting trade. This waste matter consists mainly of head, bones (with adhering flesh) and skins. In the case of relatively non-fatty waste the material is simply minced and dried in a steam jacketed rotary drier until the moisture content is less than 10 per cent. Fatty waste, after mincing, is usually cooked with water and pressed, when a mixture of oil and water is removed. The residue is then dried but is still rich in fat. To make a good meal it must be solvent extracted. Fish meal forms a valuable feeding stuff mainly on account of its high protein and mineral contents, and is sold under a strict guarantee as to its composition. Stale fish waste treated by similar methods gives a valuable fertiliser.

Fish skins find another industrial use in the manufacture of fish glue. Fish bones and fish heads are also used, but skins give the highest yield of glue. The main part of the process is the hydrolysis of the fish collagen and extraction of the resulting glue with hot water, followed by evaporation of the glue liquor. A recently suggested additional source of glue is the waste liquor from fish meal plants using cooking and pressing processes. A further limited use for the skins of certain fish is in the production of leather, by processes mainly similar to those used for animal skins. So far only sharkskin appears to have been successfully exploited. The cleaned and dried swim-bladders of certain fish constitute the isinglass of commerce. They consist of almost pure gelatin.

The production of fish oils is an important by-product industry. Body oils are produced as co-products in the fish meal and manure industries and their main industrial uses are in the soap, edible fat and paint industries. Fresh liver oils for pharmaceutical purposes are now mainly made in this country in the crude state at sea on board the trawlers. The livers of mixed species are rendered by treatment with open steam when the oil is set free. At the shore factories it is cleaned from water, etc., chilled and pressed to give medicinal "non-freezing" cod liver oil. The vitamin potency varies considerably due to a variety of factors. In recent years the production of high potential oil (such as halibut liver oil) has been developed. These are usually made by patented processes involving alkali digestion of the livers, since steaming fails to liberate the oil. Apart from its medicinal and veterinary uses, cod liver oil, when unfit for such purposes, is used in the soap and leather industries. Certain fish oils may also be valuable for a particular purpose.

There is still scope for the production of further useful products from fish, especially such preparations as gland extracts, etc. A liver extract from fish was found to be very potent in the treatment of pernicious anæmia.

De-Greasing Metal Prior to Vitreous Enamelling

Relative Merits of Trichlorethylene and Alkalies

AT the invitation of Imperial Chemical Industries, Ltd., the Institute of Vitreous Enamellers held a meeting in the exhibition room at Imperial Chemical House, London, on January 15, at which Dr. N. R. Hood presented a paper on the de-greasing of metals prior to vitreous enamelling. The paper dealt especially with modern non-inflammable solvent methods. Mr. V. C. Faulkner (of the Institute of Vitreous Enamellers, and a past-president of the Institute of British Foundrymen) presided. A number of exhibits of I.C.I. products of interest to vitreous enamellers were shown in the exhibition hall.

In his introduction to the subject Dr. Hood pointed out that under modern conditions the manufacture of even the simplest metal article entailed the contamination of its surface with oil and grease, the removal of which, as completely as possible, was essential before such finishing processes as plating, painting or vitreous enamelling could be applied. De-greasing methods he described as being of three distinct classes: (1) mechanical, such as simple wiping or sand blasting; (2) destruction of the grease by burning off; and (3) chemical, using either alkalies or organic solvents. The last class had the widest application in modern industry.

Disadvantages of Mechanical Methods

Comparing the various methods, he said that mechanical methods, so far as vitreous enamelling was concerned, were limited to surfaces such as cast iron, the porous nature of which prohibited the use of alkalies and solvents. The desired cleaning was carried out by sand blasting, which at the same time removed blemishes and irregularities from the cast surface. Burning-off could not be applied to surfaces likely to suffer deterioration by oxidation, and in vitreous enamelling it was limited to the treatment of close-beaded work, where it had certain definite advantages over other methods. It was the only satisfactory method of getting rid of the lubricant used in the turning over of the sheet. It also served the double purpose of de-greasing and annealing after the beading operation. At the same time, the resultant loosening of oxide scale and rust simplified the subsequent pickling process, but against that advantage must be placed the corresponding increase in the time of pickling and consumption of acid. Chemical methods, employing alkalies and solvents, were much more general in application than either of the two other methods. They depended upon immersion and/or spraying of the dirty articles in a bath containing the solvent or alkalies in hot aqueous solution.

Requirements in Alkali De-greasing

Dealing more fully with alkali de-greasing, Dr. Hood said that alkali baths depended for their de-greasing and cleaning efficiency upon the fulfilment of four main requirements. They were, first, high wetting and penetrative power, which in turn depended on the lowering of interfacial tension between the dirt particles, the oil and the metal; secondly, high emulsifying power, which was essential when dealing with mineral oils which could not be saponified in the ordinary way; thirdly, the ability to maintain solid particles of dirt in suspension; and fourthly, ease of rinsing. Soap was the cheapest and most economical material for ensuring the fulfilment of the first three of those conditions. It was one of the best known materials for producing a reduction of interfacial tension, but the formation of insoluble compounds with certain metallic ions, decomposition by acid solution and salting out by strong alkali solutions limited its use.

In general, mixtures of alkalies such as caustic soda, sodium carbonate, sodium silicate, sodium phosphate and soap would satisfy the conditions mentioned for the type of cleaning required prior to vitreous enamelling. The general idea that the more concentrated the alkaline solution the better were the cleaning results was entirely incorrect. Cleaning efficiency was not directly proportional to the strength of the alkaline solution. The most useful range of strengths was from 1 to 4 per cent. Trisodium phosphate was commonly added to alkaline cleaning mixtures for ease of rinsing. It allowed the alkaline solution to be removed readily during the rinsing process. It was obvious that a process which depended upon so many complicated factors for its efficiency could not be considered the acme of perfection, as the breakdown of any of the factors mentioned, even to the slightest degree, would result in incomplete de-greasing, which would immediately be reflected in the quality of the final finish. Alkaline cleaners, however, must be applied wherever soap spun work had to be treated, for there was no other process which would remove soap lubricant so effectively.

The latest development in metal cleaning was the use of organic solvents. In contra-distinction to alkaline cleaning, it depended upon solution of oil and grease. The ideal solvent cleaning process was one in which the dirty articles were subjected to a continuous stream of clean liquid solvent which dissolved and washed away the grease present. With such a process complete cleanliness was assured, since all the lubricants were dissolved and the surface was finally swilled with clean solvent. Since the rate of solution was naturally greatest when the solvent was hot, the use of petroleum spirit or white spirit for the purpose was impracticable owing to the fire risks involved. If baths of cold solvent were employed, then once a load of dirty work had been placed in the bath, the solvent was contaminated with a small concentration of grease, and on withdrawal of the load the film of liquid solvent left on the work must contain its grease concentration. When that film evaporated into the surrounding atmosphere, outside the apparatus, the small quantity of grease, being non-volatile, was left upon the metal surface. Evaporation of that film of inflammable solvent into the atmosphere external to the machine was undesirable, as it increased the fire and explosion hazard.

Almost Ideal Cleaning Agents

The non-inflammable chlorinated hydrocarbon solutions, of which the best known was trichlorethylene, were almost ideal as metal cleaning agents. Trichlorethylene, in addition to being non-inflammable, had a vapour heavier than air. Since the rate of solution of grease increased with an increase of temperature and the rate of evaporation from any surface also increased under those conditions, it was desirable that a solvent cleaning process should be operated at an elevated temperature, the most obvious temperature being the boiling point of the solvent. Under those conditions, rapid evaporation occurred as soon as the articles were withdrawn from the hot zone, and that evaporation would produce higher local concentrations of the solvent than the slower rate of evaporation from a cold surface where diffusion and dispersion by draughts could readily occur. If a cooling means were provided in the immediate vicinity of the drying-off zone, the evaporated solvent would be condensed on the cooling means, and would be recovered and returned to the system. All trichlorethylene degreasing plants operated in that way.

The simplest type of plant involved the use of solvent vapour. The vapour produced by the evaporation of the solvent into a suitable container had no de-greasing action whatever when in the vapour phase, since grease removal depended upon solution in liquid solvent. Solution could be brought about either by dipping in the boiling liquid or by allowing condensation of solvent vapour to take place upon the cold article, by virtue of the difference in temperature between the article and the solvent vapour. Such temperature difference was essential before the process could operate. A film of warm liquid solvent was then condensed upon the

metal surface, and as the liquid was condensed at the boiling point of the solvent the rate of solution of the grease was very rapid. The solvent condensed in that way was subjected to slight cooling by the contact with the cold metal surface and the metal surface itself was gradually warmed up by the transference of heat from the solvent to the metal.

The grease-carrying solvent ran off the metal surface into the base of the container, where it was re-evaporated, and further condensation of solvent continued until the heat absorbed by the metal had raised the metal temperature to that of the solvent vapour. When that point was reached, no further condensation could occur, as the temperature difference between the work and the vapour had been eliminated, and therefore no further grease removal could take place. At that stage, sufficient clean solvent had usually passed over the metal surface to have dissolved the whole of the grease film and also had given the surface a final wash with pure solvent. The process approximated to the ideal so far as the work was given a continuous wash with pure liquid solvent and the metal surface after such treatment should be free of soluble grease.

A Cyclic Process

The process was cyclic, involving the production of solvent vapour by boiling, the condensation of the vapour into liquid on a cold metal surface immersed in the vapour and the re-evaporation of the condensed solvent into vapour. Any dissolved grease or oil would remain in the base of the apparatus, as the boiling points of such materials were higher than that of the solution. The so-called vapour de-greasing process could not remove anything other than grease, and its efficiency depended on the heat capacity of the work. But it was sufficient in most cases to remove the whole of the grease film and to give the surface a final wash with pure solvent. For example, a piece of $\frac{1}{8}$ in. iron plate, 5 ft. by 2 ft. in size, immersed in trichlorethylene vapour, would be subjected to a wash of approximately half a gallon of pure liquid solvent, which was ample for the complete removal of the usual quantities of oil and grease found on plates used in the vitreous enamelling industry. Copper and aluminium would condense smaller quantities. Plants could be designed to degrease one ton of $\frac{1}{8}$ in. thick steel plate in fifteen to twenty minutes.

If the surface of the metal were covered with dirt as well as grease, then only that proportion of dirt which was mechanically washed off by the condensation action could be removed.

Removal of Solids

The fact that the surface was left in an entirely grease-free condition as a result of the treatment rendered the removal of residual solids less difficult, however, since the dirt was left without a bond and it could be removed very easily by a dusting or similar process. The action of the pickling solution was often sufficient to remove such solid contamination. Where it was desired to remove solids at the same time as the grease, the process must be modified to include a wash in boiling liquid solvent. Plants for that purpose were available, so designed that the liquid bath was continually replenished with clean solvent. The greasy work was first subjected to the action of vigorously boiling solvent followed by immersion in vapour. The liquid bath was fed with distilled solvent during the whole of the time of operation of the plant and an equal volume of contaminated solvent was drained away in order to maintain the equilibrium of the system. The dirty solvent entered an evaporation chamber where solvent vapour was produced; that was condensed on a cooling coil and returned to the liquor section of the plant. The grease and dirt were retained in the regeneration compartment.

As to the reason for the final immersion in vapour, it was obvious that unless a load of work were left in the solvent bath for an abnormally long time, the bath must always contain a trace of grease and when the work was withdrawn the surface after drying off would retain the amount of grease present in the evaporated solvent. Although that amount of grease would be very small, its removal was essential, and that was effected by transferring the work to a vapour degreasing zone incorporated in the plant.

Liquor de-greasing differed from so-called vapour de-greasing in that the heat capacity of the work had no bearing whatever on the efficiency of the process. The liquor degreasing was recommended for certain classes of metal whose open grain allowed penetration of pressing oil, for it was more efficient for that purpose than simple vapour treatment. Another attractive feature of the solvent cleaning process lay in the fact that it was possible to de-grease substantial quantities of work in a comparatively short time.

Equipment designed to operate on chlorinated solvents must possess certain features in order to prevent excessive solvent loss during operation. Thus, all solvent de-greasing plants incorporated some means of applying heat to the liquid, cooling coils at the top to control the vapour, means of reducing natural diffusion losses, doors for the removal of accumlated dirt and grease, and automatic control of the vapour level. Their operation was so simplified as to enable them to be run satisfactorily and economically by ordinary process labour after only a few hours' instruction. The results obtained by that method showed a marked improvement over those obtained by any other process at substantially the same cost. For greatest economy, the plant should be operated at maximum capacity. To obtain a true comparison on a cost basis, consideration must be given to the increased output and general efficiency of the process, and to the more uniform results obtained over any given period.

Points from the Discussion

Mr. W. H. WHITTLE (chairman, Institute of Vitreous Enamellers), expressing indebtedness to Dr. Hood, said one of the difficulties of the jobbing enameller or sign enameller in regard to de-greasing was that he had to deal with a multiplicity of shapes and sizes. But in the bulk production of articles to a reasonably uniform size and shape the alkali and solvent processes had various advantages. Hydrofluoric acid had been used for cast iron and made a particularly keen attack on silica; it gave very satisfactory results where castings had to be painted afterwards. He had not tried it for castings to be used for vitreous enamelling, but he did not see why castings so treated and subsequently hot washed should not be as good and as economical as those subjected to shot blasting.

Mr. J. T. GRAY, referring to the trichlorethylene de-greasing process, asked why under certain circumstances there was a slight greenish streaking of the ware, notwithstanding that the plant was operated under the supervision of an expert or a service man acting for the supplier of the plant, and that the subsequent pickling had been correctly carried out.

Mr. PERCY STONE suggested that probably some useful information could be imparted as to the lubricants which should be recommended to those who stamped or pressed the material to be enamelled, and as to the type of cleaner that should be used to remove them. Some makers used only mineral lubricants and others used a soap compound, and there were many enamellers who could not understand why any one type of cleaner would not remove all those different lubricants.

One of the troubles in connection with vapour de-greasing was that sometimes the solvent was cupped in a hollow in the surface of the material. He had heard some people insist that if the material were left in the tank for an hour they could get rid of that trouble. He had gathered from the paper, however, that the quicker they were in the bath and out again the better. He had found in practice that the combination of a caustic cleaner or other alkaline tank and trichlorethylene would give excellent results. He used the alkaline tank first and found that the grease would rise to the top of the water and then he had put the articles into the trichlorethylene. By that means the cupping of the solvent was avoided.

Mr. E. EDWARDS, commenting on the author's statement that with 16 gauge material a certain evaporation occurred and that with heavier gauges there was a larger amount of evaporation, asked whether the trichlorethylene bath would be less efficient with lighter gauge material and whether a point was reached at which he would not recommend it.

Effect of Weather Conditions

Mr. J. H. COUPE (hon. secretary, Southern Section of the Institute of Vitreous Enamellers) said that in his use of the trichlorethylene bath he had found that unless the metal sheets were used fairly soon after they were taken from the bath they suffered a certain amount of rusting. He had also found that in damp hot weather the action in the bath was less satisfactory than on an ordinary dry day. The plant removed the grease quite well, but in cases where the metal had been ground or polished and where a certain amount of grit remained, that grit was very detrimental in succeeding operations. It would be of great advantage to have a more efficient method than was available so far for trapping the rising vapours in the vapour de-greasing process, there being an excessive amount of such vapours produced in his experience. Apart from the difficulties at the plant itself, he had found that the vapours percolated into other departments and gave rise to difficulties, particularly where synthetic materials were being used; the vapours would get into the gas burners of the baking stoves and their effect upon the synthetic finishes was detrimental.

Mr. E. J. GROOM asked whether it was possible to use a vapour de-greasing plant to remove graphite which had been used as a lubricant because it had been found extraordinarily troublesome, particularly where pickling was necessary. In connection with some research on the corrosion of petrol tanks, in which it was found necessary to de-grease the samples of tinplate used, trichlorethylene vapour was not effective, whereas actetone was effective. The difficulty with trichlorethylene had been attributed to the effect of the pores in the tinplate.

Dr. HOOD, replying to the chairman, agreed that hydrofluoric acid was probably one of the best substances known for the removal of casting sand from cast iron, but his own personal opinion was that it was a poor grease remover. He suggested that the most efficient method would be to remove the grease in the normal way and then to subject the article to treatment by hydrofluoric acid.

Streaking Phenomenon

Replying to Mr. Gray, he said that he had experienced the streaking phenomenon on Armco iron sheet. One firm had obtained very erratic results with a vapour de-greasing plant, but only on Armco iron sheet. Examination of the sheet had shown that it had a very open grain, and from micro photographs it was found that the pressing oil which had been used on the sheets had penetrated into the metal, so that after the vapour de-greasing there was still a slight trace of oil left in the pores. In further experiments it was found that if the sheet were placed in boiling liquid before vapour de-greasing, the whole of the grease was removed and there was no residual trichlorethylene remaining in the pores of the sheet. Subsequent tests had shown that among 1,000 pieces of metal treated in that way there was not a single reject, whereas in cases where the vapour de-greasing process alone was used, the rejects amounted to between 7 and 10 per cent. He believed that streaking usually occurred because the vapour de-greasing process did not remove the whole of the pressing oil from the interstices of the metal, but he was confident that usually the trouble could be overcome by treating the metal in boiling liquid.

The problem of the lubricant that should be used was rather outside his province. The lubricants that he was concerned with generally were mineral oils and he was not prepared to indulge in any discussion of the merits of sulphonated oils, and other oils of that nature. Certainly soap could not be removed by trichlorethylene which after all functioned only because it was a solvent. The properties of trichlorethylene rendered it satisfactory for the purpose of de-greasing, but soap was insoluble in trichlorethylene and therefore, the only way to remove soap was to use some cleaning agent which would dissolve it, and that agent was alkali.

Discussing hollow articles, Dr. Hood said that no matter how long such articles were left in the bath, the solvent would not evaporate. If the solvent were cupped in a depression in the article, it would remain there unless it were removed by the tipping of the article or by some other mechanical action. Generally a plant for dealing with small articles was devised to turn those articles over throughout the period of the de-greasing. He agreed with Mr. Coupe that the best method of operation was to use trichlorethylene de-greasing first and if necessary to use alkaline de-greasing afterwards.

Replying to a question by Mr. Edwards as to whether vapour de-greasing would remove all the grease in one operation from a very light gauge material which was covered with a reasonable quantity of grease, Dr. Hood said it was necessary either to remove the material from the bath, allow it to cool off and then put it back again, or to subject it to the action of boiling liquid. He would recommend the use of boiling liquid; it was entirely independent of the gauge of the article and in general it was a process that was preferable for application to light gauge material.

Rusting of Steel

Rusting of steel would occur very rapidly after trichlorethylene de-greasing, particularly in a humid atmosphere; that was not because the trichlorethylene had had any mysterious effect upon the steel, but it was due simply to the fact that the steel was entirely free from any grease protection. Any article which had been trichlorethylene de-greased should be processed within a minimum of time after de-greasing

Dealing with Mr. Coupe's suggestion that in damp weather the trichlorethylene process was not so satisfactory as in dry weather, Dr. Hood wondered whether there was any water present in the trichlorethylene bath or whether the articles were covered with water at the time they were put into the bath. Otherwise, he could not see any reason why articles which were de-greased in dry weather should not also be de-greased in damp weather. For articles which were wet with liquid water, vapour-degreasing was not good, but boiling liquid should be applied. The reason for that was simply that trichlorethylene worked by solution, and where there was a globule of water the trichlorethylene could not get into contact with the grease.

Solids, such as grit and abraded steel, were definitely removed by boiling liquid. There had been many instances of that; if a material which had been treated in boiling liquid were wiped with a perfectly clean handkerchief, it could be proved that there was very little grit remaining.

In reply to Mr. Groom, Dr. Hood said that trichlorethylene would not remove graphite from large pressings. He would like to investigate the reason why, as mentioned by Mr. Groom, acetone had functioned as a grease remover where trichlorethylene had not. The only suggestion he could make at the moment was that the particular lubricant used was more soluble in acetone than it was in trichlorethylene.

THE following were elected to membership at a meeting of the Board of the Institute of Physics, on January 13:—Fellows: J. M. Bruckshaw, A. M. Cassie, W. H. A. Fincham, N. R. Fowler, J. Iball, R. W. Hunt, L. H. H. Orton, W. H. Taylor, and F. W. G. White. Associates: T. E. Banks, R. Beeching, W. F. Floyd, H. R. Hindley, E. G. Knowles, R. L. Maughan, A. Porter, S. Rajaraman, E. W. Roberts, S. Venkataraman, E. C. Williams, and S. E. Williams. Students: W. Abson, R. H. Barker, P. R. Brown, D. E. Clark, R. N. Crookes, R. C. Dell, W. C. Fahie, W. Hirst, A. W. Lines, F. Molyneux, R. H. Peters, A. C. Purdie, G. Selwood, R. Watts, and R. T. P. Whipple.

" Our Society and Ourselves "

The Activities of the Society of Dyers and Colourists Reviewed

A MEETING of the Manchester Section of the Society of Dyers and Colourists was held on January 15, in the Lecture Room of the Literary and Philosophical Society, when Mr. C. J. T. Cronshaw, B.Sc., F.I.C., gave an address on "Our Society and Ourselves." Mr. N. Chappell, M.Sc., presided.

Mr. Cronshaw said there were several societies concerned with chemistry and its application. There was, first, the Chemical Society, the elder brother chiefly concerned with chemistry as a science. Second, there was the Institute of Chemistry, which catered for chemistry as a profession, its status, its standards, and, as far as it could, its rewards; its concern was the individual and not so much the thing itself. Third, there was the Society of Chemical Industry with a wide and comprehensive interest in the gamut of chemical technology. Lastly, and only modesty adopted this order of precedence, there was their own Society of Dyers and Colourists, which catered for the diverse technology of the colouring, both by dyeing and printing, of textile fibres.

All these societies were of mature growth and considerable reputation before the beginning of the twentieth century, and had, therefore, all celebrated a jubilee. They all issued a journal which had become part of the scientific organisation of the country. They were all, except the Chemical Society, to some extent decentralised in that they had sections up and down the country.

Two Excellent Pieces of Work

The Society of Dyers and Colourists had carried out with great prestige two excellent pieces of work; the Colour Index which had deservedly become the classic work in the English language on dyestuffs, and the work recently completed of establishing a standard series of tests for fastness of coloured fabrics. No one could question the usefulness of these two contributions and have any doubt about the prestige which they earned for the society. But did they strengthen the link between the society and the individual? He feared not. They were essentially a service to the industry generally, and had no paramount individual or specific appeal.

Mr. Cronshaw then asked them to look at another phase of the society's activities. The society had instituted the Perkin Medal, which was awarded at intervals of two or three years for discoveries or work of outstanding importance in connection with the technical arts. Since it was instituted in 1907 there had been nine awards. They were all, he freely admitted, well within the terms and conditions, but none had the quality of appropriateness in point of time which he thought would have enhanced the dignity of the award. The Graebe and Liebermann synthesis was effected in 1868-69; the medal was awarded in 1908. Baeyer synthesised indigo in 1869; the medal was awarded in 1911. Green discovered primuline in 1887; the medal was awarded in 1917. Vidal discovered his sulphur black in 1893; the medal was awarded in 1919.

Must the award tarry 30 years behind the event, or was it impossible for the society to be a little more *apropos* in its gifts? Taking the medal of the Society itself, this could be awarded in the interests of the tinctorial and allied industries, but there had been none apparently which the Society considered merited that description since 1912.

The Value of Text Books

Dealing with the matter of textbooks, Mr. Cronshaw stated that they were the currency of technology. Knecht's "Manual of Dyeing" originally saw the light of day in 1897, and the latest edition bore the date of 1919. C. M. Whittaker's "Dyeing with Coal Tar Dyestuffs" was only available in an edition dated 1926. "The Dyeing of Textile Fibres," by Horsfall and Lawrie, written in 1927, was still unrevised and out of print. "Textile Bleaching, Dyeing and Finishing Machinery," by A. J. Hall, was published in 1926. Trotman's "The Bleaching, Dyeing and Chemical Technology," was published in the same year. "Textile Printing, Principles and Practice" appeared in rather better shape, for there was a third edition, revised by Fothergill, dated 1936.

Textbooks were the bequests of the present generation, and in part the seed for future harvests. Perhaps the society could look into the matter, and see whether they could not arrange for a series under their own imprimatur, and assume the responsibility for seeing that authoritative and up-to-date textbooks should always be available. Perhaps, too, the society might consider issuing an annual memoir on progress and development.

In conclusion, Mr. Cronshaw advocated the giving of an annual series of semi-popular lectures similar to the Cantor Lectures of the Royal Society of Arts. He was also of opinion that the more frequent holding of symposia would be desirable, and that greater encouragement should be given to the younger members of the society to become more vocal in the discussions of the papers presented.

New Alloys for Aircraft Construction

Beryllium Expectations not Realised

As the standards of aircraft performance are raised, possible saving of weight is becoming of ever greater importance so that more and more interest is being taken by aircraft constructors in metals lighter than aluminium, said Professor C. H. Desch, Superintendent of the Metallurgical Department of the National Physical Laboratory, in a paper on magnesium and other light alloys read before the Royal Aeronautical Society on January 14.

Beryllium has unfortunately disappointed expectations, for although its crystal structure indicates that it should be possible to render it dustile, all the metal so far produced has proved to be brittle, nor has any means been found of alloying it with small quantities of another metal so as to make it ductile. With a specific gravity of only 1.84, an elastic modulus which is believed to be very high, and a melting point of 1278°C., beryllium would seem to offer remarkable advantages, but the long investigations carried out in Berlin and at the National Physical Laboratory have not so far resulted in the production of new light beryllium alloys, although attention is now being again directed to the alloys with aluminium. At the other end of the series alloys of copper and of nickel, containing small quantities of beryllium, have shown remarkable properties and have found technical application. The metal still continues to attract inventors and prospectors, from the feeling that it would be an admirable material of construction, alone or in an alloyed form, if only it could be produced in a suitable condition.

It might have been expected, continued Professor Desch, that a useful alloy could be made by combining beryllium with magnesium, but this has not proved to be the case. The

reason lay in the fact that the effective diameter of the magnesium atom is much larger than that of the beryllium atom—spheres of such different sizes not being able to pack closely together.

It is remarkable how often purely geometrical factors outweigh those of chemical similarity in determining the structure of alloys, and new light is constantly being thrown on metallurgical problems by the application of ideas of atomic arrangement in metallic crystals. It is becoming more and more possible to decide beforehand which elements may with advantage be added to a given metal to produce a useful alloy with given properties, although the complexity of most of the mechanical properties prevents the process from being quite simple. It may, however, be said that theoretical knowledge plays an ever-increasing part in the development of alloys.

Magnesium is too weak a metal to be used in the unalloyed state, and the metals which may be added to it to produce strong alloys are limited in number. In fact, taking all the factors into account, only aluminium and cadmium are suitable for alloying in comparatively large quantities, although calcium, cerium, nickel, cobalt and manganese have proved useful in small quantities. Magnesium alloys are remarkably easy to cast. This comes about from the fact that molten magnesium has very little power of dissolving gases, so that magnesium alloys do not suffer from the sponginess caused by the liberation of gases at the moment of freezing. In casting it is necessary to use a suitable flux and a protective atmosphere during pouring. These conditions, Dr. Desch said, are now well understood and no difficulties are experienced in the foundry. In annealing processes similar protection is necessary, and the special technique adopted has resulted in making a magnesium alloy foundry a remarkably clean and inoffensive place.

Excellent castings of magnesium for the production of aircraft parts which are not too highly stressed can be produced, and it is possible to make intricate shapes without great difficulty. Both sand and chill castings are used. By casting in dies very satisfactory castings, involving a minimum of machining, are obtained with a higher strength than sand castings.

In discussing the "working properties" of magnesium alloys, Professor Desch described how the crystalline structure of the ingots affected the process of working. The form of the crystals in magnesium alloys was such that it was possible to produce material which was ductile in one direction and brittle in another. Such difficulties were overcome by making the crystal grains as small as possible by casting the ingots at a high temperature. The ordinary breaking down of the structure of the ingot by rolling or hammering readily causes cracking of magnesium alloys even when the reduction at each stage is small, and this is one of the principal difficulties of manufacture.

Although data as to the actual properties of magnesium alloys under prolonged stress at high temperatures are somewhat scanty the indications are that the new alloys retain their strength remarkably well at high temperatures.

Patent Litigation

Petition for Extension Refused

IN the Chancery Division on Wednesday Mr. Justice Luxmore concluded the hearing of a petition by the British Oxygen Co., Ltd., Dr. Christian Wilhelm Paul Heylandt, of Berlin, Heylandt Gesselschaft Fur Apparatebau mit Beschrankter Haftung, of Berlin, Britz Aktiengesselschaft fur Industrie, Gasver Wertung, a Swiss company, and Metal Industries, Ltd., of Glasgow, asking for the extension of letters patent granted to William Edward Evans on July 12, 1920, numbered 149, 233.

Sir Stafford Cripps, K.C., Mr. Trevor Watson, K.C., and Mr. R. Jones appeared for the applicants and Mr. Heald and Mr. Graham for the Comptroller of patents in opposition.

Sir Stafford Cripps said that Dr. C. W. P. Heylandt was the inventor of an invention relating to the liquefying of gases, their storage and transport in a liquidfied state. The letters patent related to improvements comprised in his processes and disclosed an important method of dealing with liquified gases. The German and Swiss companies were formed to take over and develop the patent. The invention was communicated to Mr. Evans, a patent agent in this country, for the purpose of obtaining letters patent here and to see if it were possible to exploit the matter here. Subsequently a licence to work the patent was granted to Metal Industries, Ltd. The patent expired in July, 1936.

To deal with the patent the applicants had had to erect very expensive plant, and the cost had been some £200,000. This money had been expended in developing the business by the British Oxygen Co. So far there had not been a very great recoupment, and the applicants now asked for an extension of the patent so that they might recoup themselves for the very great outlay in developing the patent.

Mr. Heald said as no appropriate account had been produced, the Court could not extend the patent.

His lordship, in giving judgment, reviewed the facts of the case, and said he had had before him a number of accounts from the applicants, but he had considerable difficulty in arriving at any satisfactory conclusion as to the remuneration paid in respect of the patent. In considering the question of extension of the patent the question of remuneration played an important part. Here Metal Industries acquired the patent in 1929, and they had paid the German company a considerable sum for the privilege of the exclusive licence. There had been a dispute between the Oxygen Co. and Metal Industries, and there was an action in the Courts, but that was settled with the result of an amalgamation of the two parties. It was obvious that the company had worked at considerable profit as its original shares had risen from 12s. 6d. to £7. Here the British Oxygen Co. required the patent knowing there was only $3\frac{1}{2}$ years to run. In spite of that the accounts proved most difficult to investigate. Under those circumstances the question of extension of the patent was a difficult one. He had the greatest difficulty in ascertaining what sort of remuneration had been received by the persons interested here. He was quite unable to come to a conclusion as to the remuneration received and he was not in a position to make even a fair guess as to the remuneration. Inadequate accounts had been kept.

Under the circumstances he was unable to say that any of the persons who had been interested in the patent had been inadequately remunerated and therefore the petition must be refused.

MR. R. W. JAMES, reader in experimental physics at Manchester University, has been appointed Professor of Physics at Capetown, and will be leaving England in about two months. Mr. James went to Manchester at the end of 1918, and almost from that time onwards he has been working with Professor W. L. Bragg in the investigation of the structure of crystals. A considerable amount of his work has been concerned with heat vibrations in atoms, which are apt to weaken the structure of the crystals. This work has been of great assistance to Professor Bragg and his colleagues for the elucidation of crystal structures.

Zinc Oxide Industry

More Co-operation between Manufacturer and User

PROGRESS in the British zinc oxide industry was reviewed by Mr. L. McNaughton in an address which he gave on January 15 to members of the Manchester Section of the Oil and Colour Chemists' Association. The zinc oxide industry was an Empire industry and made big use of Empire metals imported from Australia, Canada and South Africa.

Discussing the processes of manufacture, Mr. McNaughton said that at first the oxide had a yellowish tone, due to the fact that it contained cadmium oxide, for zinc metal was never cadmium-free. The amount of CdO varied considerably with the class of metal used, but in the case of electrolytic metal the oxide contained only traces of cadmium, which nevertheless showed its characteristic creamy tone. As the charge progressed, we passed to good red and then white seals, then back to red seals, and tailed off to low reds and a small proportion of off colour, the lead content at the same time steadily mounting to a limit determined largely by the class of metal used. In the early days of the industry in this country the raw material was almost exclusively hard spelter and virgin spelter. The oxide would obviously contain a good deal of lead and some iron, and anything up to 0.10 per cent., or in some cases even more of cadmium.

Principal Uses of Zinc Oxide

The field of users of zinc oxide was much wider than most people imagined, but the principal uses were for the paint and rubber trade. Among other uses were printing inks, calico and silk printing, dyeing, linoleum, matches and pottery.

The paint manufacturer is mainly concerned with the following properties: (1) colour; (2) fineness; (3) opacity; (4) oil absorption; (5) permanence. The fineness of the zinc oxide gives it the property of remaining in suspension when made into paint by grinding in a suitable medium, and also as the particles are too fine to be seen with the human eye, such a paint gives a surface which is flat and even producing the appearance of gloss. Both these properties are useful to the paint manufacturer particularly.

Zinc oxide is an opaque substance; when incorporated in a paint it has the property of hiding, or masking, the surface over which it has been painted. So far as direct and indirect oxides of the better grades are concerned, there is little difference of opacity between them. The indirect oxides are a little more opaque as a rule owing to their finer particle size. Among lower grades of direct oxide where some considerable amount of lead sulphate enters into the composition of the oxide, the opacity may be considerably above normal. Most manufacturers avoid the use of high acid value vehicles, by testing the oil and varnishes used for acid value, which gives them a measure of the acidity in terms of mgms of KOH.

Conditions in Rubber Works

While this control method is most desirable, it only measures the amount of acidity in terms of an alkali, and gives no information whatever as to the type of acid or to its reactivity to zinc oxide. It is possible to have two vehicles with the same acid value which will give entirely different results when made up into paint with zinc oxide.

As regards conditions in the rubber works, the manufacturer specified his requirements for zinc oxide in almost exactly the same manner as the paint maker. The physical characteristics required were colour, fineness, opacity and permanence. Each individual rubber manufacturer had his own particular schedules for rubber composition and these were so varied that it was almost hopeless to generalise, as the same oxide would give entirely different results with the varying accelerators used in the different schedules.

In view of the various schedules used by paint manufacturers, a little closer co-operation might produce beneficial results similar to those we have been able to effect with the rubber trade, said Mr. McNaughton. Most members of the paint trade took the wider and more scientific viewpoint, but there were still some who unhesitatingly condemned an oxide if it did not give good results, even with an unsuitable vehicle.

Letter to the Editor

British Camphor Trade

SIR,—One of the lessons of the war was the importance to the nation of its chemical industry, and large sections of that industry were brought under the protection of the Key Industries Act long before the imposition of a general tariff. It is surprising therefore that the National Government, which has done so much to help industry in general, should by its continuous inaction impose a serious tax on a chemical manufacture which, although comparatively small, is of great importance to other industries and would become far more so in a time of national emergency. I refer to the incidence of the hydrocarbon oil duty on oil of turpentine, which is the raw material for the manufacture of camphor.

Before the war the manufacture of camphor was often quoted as one of the outstanding achievements of German applied chemistry. The German process has been continuously improved, but at the present time the British process, after 10 years of research and a heavy expenditure on buildings and plant, is little if anything below the German in efficiency. It is already supplying the needs of the British celluloid industry, and it could easily be expanded to supply the requirements of the British Empire. It is, however, badly hampered by the duty of 8d. a gallon on oil of turpentine. This duty increases the cost of camphor by 15 per cent. Further, so long as the duty is levied the future of camphor manufacture will be subject to uncertainty as to whether the hydrocarbon oil duty may be raised (as it has been on two occasions already) by Chancellors looking for additional revenue.

No serious arguments have been adduced against the case for exemption or repayment. The stock Treasury view that this tax is as sacred as the Ark of the Covenant is not without its humorous side to those who remember how the tax on kerosene, which was originally included in the hydrocarbon oil duty, was dropped like a hot potato within a few hours of its having been proposed. The argument that if oil of turpentine for camphor manufacture is freed from the tax white spirit will have to be freed also is due to confusing this manufacture with the paint industry. White spirit is a raw material for paint, but it cannot be used for camphor manufacture, so there is no competition between the two in this respect. Nor, of course, is there any competition with petrol, whether imported or made by the hydrogenation of coal.

There would be no administrative difficulty or novelty in arranging for a repayment of the duty when turpentine is used for camphor manufacture. Alcohol, which is far more heavily taxed, has been used duty free in the British chemical industry for years, and the arrangements work smoothly and well.

Nobody benefits from this tax on British camphor manufacture except the foreign manufacturer of camphor and the foreign manufacturer of celluloid, and the only obstacle to its removal is the indifference of the Treasury and its advisers.—Yours faithfully,

C. F. MERRIAM.

The British Xylonite Co., Ltd., Hale End, E.4.

BRITISH Colonial and Eastern Chemicals, Ltd., with a capital of £25,000, has been registered in Sydney, Australia.

Platinum Metals in Bullion

Cupellation and Detection

CUPELLATION and the detection of platinum metals in bullion formed the subject of an address delivered by Professor C. O. Bannister, of Liverpool University, before the Liverpool and North-Western Section of the Institute of Chemistry on January 14. The chairman, Mr. L. V. Cocks, presided.

Dealing with the process of cupellation as used for the determination of silver, gold and platinum metals, Professor Bannister said that this method was seldom used by analytical chemists outside metallurgical laboratories, and was one capable of giving extreme accuracy, as was necessary when dealing with such valuable material. It was capable of indicating and being used for determining as little as two parts per million of gold or silver. He illustrated the various structures by means of lantern slides.

The following new Associates of the Institute were formally admitted and presented with their certificates by the chairman: Messrs. C. J. Lewis, J. C. Murphy, H. B. W. Patterson, J. G. Rimmer, J. Sowler, and T. S. Subramanian.

Federation of British Industries

Lord Hirst Nominated as President for Second Year

THE Grand Council of the Federation of British Industries has approved the nomination of Lord Hirst for the office of president for the coming year, which commences in April.

Lord Herbert Scott, who proposed the nomination, said the year which lay ahead promised to be one of exceptional importance, and, in particular, there would be questions of inter-imperial trade to be settled during the summer. Lord Hirst, before becoming president last year, had been for some years chairman of the Federation's Empire Committee, and had always been ready to associate himself with any movement designed to improve Empire relationships.

Lord Barnby, another past president, substantiated Lord Herbert Scott's remarks, and assured the members that they would be fortunate if Lord Hirst would consent to carry on for another year the great work which he had already performed for the Federation and for British industry.

Lord Hirst promised to do all in his power to further the interests of British industry.

Patents Applications in 1936

Inventive Activity in the Chemical Industry

DURING 1936, some 35,900 patents were applied for. For the previous five years, commencing 1935 and going backwards, the numbers of patents applied for were 36,116, 37,409, 36,734, 37,052, and 36,117 respectively. The peak year was 1929, when the number of patents applied for was 39,898. It must be remembered, however, that only about 50 per cent. of patents applied for mature into full patents.

As regards the trend of invention, the Comptroller's report for 1935 refers to considerable activity in connection with the dyeing of leather, artificial resins, chemicals for treating textiles, photographic chemicals and drugs, and the development of synthetic methods of preparing sex-hormones. There was activity also in connection with devices for the detection of, and protection against, noxious and explosive gases. Development also took place in technical applications of modern discoveries in physics, including transmutation of elements by bombardment with high-speed electric particles and short-wave radiation, the mercury discharge lamp, in which a relatively minute lamp gives an intrinsic brightness hitherto unknown in practice, and powders and other substances, stimulated to luminosity by radiation from an electric discharge, which produce added light output.

There was inventive activity also in connection with whale flesh and waste products from the whale oil industry.

Future of the Gas Industry

Discussion at Glasgow

THE subject of the gas industry and the domestic consumer was discussed at a meeting of the Glasgow Section of the Society of Chemical Industry on January 15, presided over by Mr. J. W. Napier, gas engineer, Alloa, chairman of the section. A paper was given by Dr. F. S. Sinnatt, Director of Fuel Research, London, and Dr. E. W. Smith, technical director of the Woodall Duckham Companies, London.

Dr. Sinnatt said three large industries were concerned with the supply of domestic light and heat—the coal industry, the gas industry, and the electrical industry—and in certain parts of England there was growing into a healthy state the low-temperature carbonisation industry. He went on to the question of gas production in coke ovens. Much gas was produced in this way which was not used as economically as it should be, and this suggested the need for a closer liaison between the various industries supplying heat and light. It appeared that changes might take place in the methods of producing gas in the future, and he discussed one of the processes—namely, complete gasification.

Dr. Smith stated that in his opinion gas was not likely to be displaced completely by coke for domestic purposes. Coal and coke were so much cheaper per therm that, as 85 per cent. of the population were dependent on £5 per week or less, this class could not afford any but the cheapest form of fuel for their main requirements of domestic heating. The whole objective of the industry should be to produce cheaper gas. This could be done only by upgrading the other products obtained from coal.

Sir George Beilby Memorial

Awards to Dr. B. S. Evans and Dr. W. H. J. Vernon

THE administrators of the Beilby Memorial Fund have announced awards of 100 guineas each to Dr. Bernard S. Evans and Dr. William H. J. Vernon. Dr. Evans passed the examination for the Associateship of the Institute of Chemistry in 1909 and was elected to the Fellowship in 1915. Since 1919 he has been attached to the research department of Woolwich Arsenal, where he now holds the position of a scientific officer. He was awarded the degree of Ph.D.(Lond.) in 1924 and D.Sc., in 1933. He has devised numerous analytical methods for the separation and determination of metals, and contributed the chapters dealing with the methods of analysis applicable to lead, bismuth, arsenic, antimony, tin, iron, chromium and metallic constituents of steel in Mitchell's "Recent Advances in Analytical Chemistry."

Dr. Vernon graduated B.Sc. (Birm.) in the first division in 1919, Ph.D. (Lond.) in 1924, and D.Sc. (Lond.) in 1927. After some experience as works chemist with Walker and Hall, Ltd., Sheffield, he held the appointment of demonstrator and subsequently lecturer in metallurgy at the Birmingham Technical College until the war. In February, 1921, he was appointed investigator to the newly-formed Atmospheric Corrosion Committee of the British Non-ferrous Metals Research Association.

Dr. Vernon's experimental work was carried out at the Royal School of Mines, South Kensington, under Sir Harold Carpenter, until 1927, when the investigation was taken over by the Department of Scientific and Industrial Research and continued at the Chemical Research Laboratory, Teddington, under Sir Gilbert Morgan. Dr. Vernon was elected to the Associateship of the Institute of Chemistry in 1926 and to the Fellowship in 1927, in which year he received the Diploma of the Imperial College. His publications have included "A Bibliography of Metallic Corrosion" (Arnold), the first and second reports to the Atmosphere Corrosion Research Committee (each of which formed the subject of a general discussion by the Faraday Society) and other papers.

The Chemist and the Industrialist

Mr. H. W. Cremer's Lecture

MR. H. W. CREMER, who spoke on "Pure Science, its Interpretation, Co-ordination and Application," at a meeting of the Liverpool Section of the Society of Chemical Industry on January 8, has asked us to correct some inaccuracies in our necessarily condensed report which appeared in THE CHEMICAL AGE last week (pages 45-46).

He did not suggest that post-graduate students "should limit their activities to that field on the borderland between chemistry and the other sciences," but said they might "profitably employ their somewhat increased leisure in a general study" of such subjects, and hinted that the teacher might help to correct the tendency towards a narrow outlook without interfering with the maintenance of the highest academic standards and ideals. It was during the years of post-graduate study that one should, he believed, look for the real awakening of the chemical fledgeling to his responsibilities to himself and to his future employer (not to his "tutors"). During that time he was "expected and encouraged to think, speak and act for himself; in fact he was definitely expected and encouraged to do so (not "to look after himself"). His personality emerged, and since he would before long be seeking some post in which to exercise his talents, this question of personality was surely worthy of some consideration. . . . The full value of scientific effort could only be realised in practice if handed on in a spirit of sympathy and understanding of the circumstances and difficulties of others, and he could not help feeling that many of the criticisms directed against chemists as a class were the outcome of a lack of appreciation of the importance of cultivating the art of miscibility with associates of all grades, in addition to respect for other points of view, including that of the industrialist, who was not necessarily the soul destroying monster that some scientists appeared to suppose.

Curtailment of Published Data

Referring to published results of research, Mr. Cremer said one could wish that the very laudable efforts by editors to reduce space did not result in such drastic curtailment of the experimental data on which final conclusions were based, or in other cases in their almost complete elimination.

Asking whether the academic chemist was always sufficiently alive to his great responsibilities in making available data which could be accepted as representing the height of his achievement as regards reliability, Mr. Cremer said it would be fatal to the interests of pure and applied science if the academic research worker were to feel handicapped in any way through spending a great deal of time on a problem of fundamental importance in order to arrive at its final solution and that greater opportunities for advancement should accrue to those whose work lay in what were perhaps more superficial or spectacular fields.

Dealing with application and co-ordination, Mr. Cremer said the industrialist usually knew what he wanted to do, whilst the chemist might prefer to delay his opinion and test his views by experience and possibly to suggest a full investigation of the fundamental problem involved. As a result he was not infrequently written down as wholly impractical and a dreamer, and what some regarded as the gulf between theory and practice was certainly not narrowed in consequence.

Referring to the "awakening" process in chemistry students, he spoke of "refresher" lectures and those for which they looked to those in industry itself, or closely allied to it. Papers combining the theoretical with the practical must surely be of the utmost value.

Mentioning unit operations, Mr. Cremer said that since chemical engineering in practice frequently called for a combination of unit processes the inter-reation of the various brances of science which underlay them was of primary concern to the chemical engineer; he must in fact not only see things clearly (not "superficially") but see them whole.

Properties of Dyestuffs

Fastness to Light and Potting

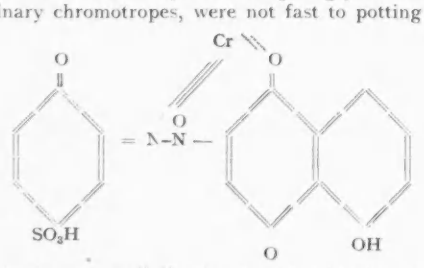
ADDRESSING the members of the Leeds Branch of the Institute of Chemistry at the Bradford Technical College last Monday, Dr. L. L. Lloyd, Ph.D. (Berne), discussed "Properties of Dyestuffs in Relation to Fastness to Light and Potting."

When dealing with a compound combined with a fibre, he said, two forms of linkage occurred—basic and two acid groups to give the necessary combination to resistance to alkali. The linkage of acid to some basic system—and nitrogen compounds of all types were basic—provided a compound which was extremely fast to washing and possessed moderate fastness to light. Because one combination gave fastness to washing, however, it must not be taken for granted that it also gave the property of fastness to potting—which was the most severe test in regard to dyestuffs in combination with wool. Briefly, the dye material—preferably neutral and certainly not acid—was boiled or heated for a long period in water. The process might be continued many times in order to get certain properties in the material. There were very, very few dyestuffs that were fast to potting for the reason that when wool was boiled with water it underwent hydrolysis. If the material was dyed with colour fast to potting no colour should be removed during potting treatment, and it should be remembered that the hydrolysis of wool could not be stopped by water.

Dealing with chromotropes, Dr. Lloyd said they were all very easily decomposed and split off by boiling with acid, so that all the chromium was abstracted. Whenever that result was found it would always be noticed that the materials dyed with these dyestuffs were not of very great fastness to milling and by no means fast to potting. Acid milling violet possessed very good fastness to light, fairly good fastness to potting and good fastness to washing and milling. As a copper lake, however, it was excellent in fastness to light, but extremely poor in fastness to milling. This copper lake was fairly easily broken by acid, and that was assumed to cause its poor fastness to potting.

One of the fastness to light colours was that used for dyeing green on the caps of the Royal Air Force. It was an after-chrome dyestuff and in his (Dr. Lloyd's) opinion, since fastness to light had not been standardised as a definite number of light units on the material, it should be regarded more as a standard than the majority of dyestuffs.

Of two blue-blacks mentioned, "B" was very much faster to potting than the "R" brand and was slightly faster to light and most other agencies. Blue-Black "B" was far more used than "R" because it did not appear as red in artificial light, though it was very sensitive to copper and iron. The "R" brand was much less fast to milling and appeared very red in artificial light. The following formula might be assumed to give a lake of Diamond Black P.V. which was probably the reason for its great fastness to potting, whereas there were other systems not giving peri lakes which, like ordinary chromotropes, were not fast to potting:



Dr. Lloyd was cordially thanked for his lecture on the proposition of Dr. Cunliffe, seconded by Mr. A. Barraclough.

Dr. R. D. Abell (professor of chemistry and head of the Chemistry Department at the College) presided, and during the evening presented certificates of the Associateship of the Institute of Chemistry to Mr. A. C. Mason, Mr. C. Breckon and Mr. J. K. Barraclough.

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MR. PERCY A. E. RICHARDS, F.I.C., who died recently at the age of 68, was in practice as a consulting and analytical chemist for a period of 30 years, in the course of which he was public analyst for the City of Westminster and the Borough of Hammersmith. He studied analytical chemistry under the late Professor C. W. Heaton. During the time he was in practice he carried out some important investigations on the so-called "facing" of rice, on vinegar and on preservatives in imported meat, on behalf of the Local Government Board, now the Ministry of Health. He served on the Departmental Committee on Preservatives and Colouring Matters in Food, and was an examiner in foods and drugs for the Institute of Chemistry examinations. He also served the Institute of Chemistry as a member of the council, and for 17 years he was one of the hon. secretaries of the Society of Public Analysts, and was president in 1922-3.

British Overseas Chemical Trade in December

According to the Board of Trade returns for the month ended December 31, 1936, exports of chemicals, drugs, dyes and colours were valued at £1,922,499, as compared with £1,779,061 for December, 1935, an increase of £143,438. Imports were valued at £1,166,984, as compared with £1,025,862 for December, 1935, an increase of £141,122. Re-exports were valued at £34,399.

Imports

	Quantities. December 31, 1935.	Quantities. December 31, 1936.	Value. December, 31, 1935.	Value. December, 31, 1936.
Acids—				
Acetic .. cwt.	17,446	19,460	24,574	22,038
Boric (boracic) .. ,,	4,800	800	4,794	999
Citric .. .. ,,	1,514	1,172	5,950	4,685
Tartaric .. ,,	980	700	3,961	2,895
All other sorts .. value	—	—	10,989	7,700
Borax .. .. cwt.	23,300	5,800	14,996	2,804
Calcium carbide— ,,	113,309	101,374	60,951	25,953
Fertilisers, manufactured—				
Superphosphate of lime tons	2,741	1,081	5,244	2,013
All other descriptions ,,	4,101	2,553	15,888	13,048
Phosphorus .. cwt.	727	1	1,970	14
Potassium compounds—				
Caustic and lyes cwt.	8,154	9,044	9,274	9,666
Chloride (muriate) ,,	15,702	46,140	4,434	15,587
Kainite and mineral fertiliser salts cwt.	32,160	34,536	3,652	3,895
Nitrate (saltpetre) ,,	40,886	23,220	17,257	9,376
Sulphate .. ,,	8,180	15,480	3,486	6,914
All other compounds ,,	10,768	12,393	17,367	19,787
Sodium compounds—				
Carbonate, including crystals, ash and bicarbonate .. cwt.	484	202	331	156
Chromate and bichromate .. .. cwt.	7,497	4,834	9,502	5,521
Cyanide .. ,,	3,754	3,208	9,186	7,854
Nitrate .. .. ,,	92,300	120,140	18,735	25,455
All other compounds ,,	33,709	28,663	22,874	19,253
Other chemical manufactures .. value	—	—	304,143	376,551
Drugs, medicines and medicinal preparations—				
Quinine and quinine salts .. .. oz.	147,817	106,661	11,913	9,055
Medicinal oils .. cwt.	1,000	3,492	3,273	11,048
Proprietary medicines value	—	—	55,440	46,883
All other sorts .. ,,	—	—	44,630	55,391
Dyes and dyestuffs and extracts for tanning—				
Finished dyestuffs from coal tar .. cwt.	3,899	5,121	111,916	145,990
Extracts for dyeing ,,	3,826	5,320	8,452	12,330
Extracts for tanning (solid or liquid)—				
Chestnut .. cwt.	28,107	30,816	19,253	20,747
Quebracho .. ,,	21,284	52,339	17,482	45,988
All other sorts ,,	26,950	34,765	18,358	25,852
All other dyes and dyestuffs .. .. cwt.	1,387	1,666	20,154	28,647
Painters' colours and materials—				
White lead (basic carbonate) .. cwt.	6,615	6,695	8,545	9,197
Lithopone .. ,,	17,813	32,526	11,468	19,770
Ochres and earth colours cwt.	31,969	31,942	11,158	12,531
Bronze powders ,,	1,605	1,906	11,908	12,782
Carbon blacks .. ,,	45,836	43,113	70,698	64,161
Other pigments and extenders, dry cwt.	30,027	37,429	8,288	10,433
All other descriptions ,,	10,955	13,152	23,368	27,375
Total .. value	—	—	1,025,862	1,166,984

Exports

	Quantities. December 31, 1935.	Quantities. December 31, 1936.	Value. December, 31, 1935.	Value. December, 31, 1936.
Acids—				
Citric .. .. cwt.	1,642	2,096	7,108	9,160
All other sorts .. value	—	—	18,952	21,587
Aluminium compounds ton	3,138	3,783	33,626	32,701
Ammonium compounds—				
Sulphate .. ,,	15,474	21,150	88,986	132,710
All other sorts .. ,,	1,986	1,057	20,722	14,876
Bleaching powder (chloride of lime) .. cwt.	59,379	61,545	17,050	15,018
Coal tar products—				
Cresylic acid gal.	169,161	185,176	15,566	27,017
Tar oil, creosote oil, anthracene oil, etc. gal.	1,262,965	5,685,579	34,906	134,834
All other sorts .. value	—	—	41,251	19,788
Copper, sulphate of ton	1,856	1,566	27,052	24,677
Disinfectants, insecticides, weed killers .. cwt.	29,385	33,008	63,747	65,684
Fertilisers, manufactured ton	9,730	25,700	44,689	66,315
Glycerine .. .. cwt.	17,306	17,197	39,850	51,629
Lead compounds .. ,,	10,169	13,655	13,530	19,518
Magnesium compounds ton	456	455	9,900	11,075
Potassium compounds cwt.	2,293	4,335	9,652	9,062
Salt (sodium chloride) ton	18,405	21,547	52,986	59,740
Sodium compounds—				
Carbonate, including crystals, ash and bicarbonate .. cwt.	491,253	499,219	109,470	95,577
Caustic .. .. ,,	230,446	231,605	115,479	95,663
Nitrate .. .. ,,	13,539	16,953	4,339	5,518
Sulphate, including saltcake .. .. cwt.	114,728	73,335	9,019	6,502
All other sorts .. ,,	62,458	64,965	76,405	88,597
Zinc oxide .. ton	1,077	796	19,980	15,527
All other descriptions value	—	—	244,549	222,498
Drugs, medicines and medicinal preparations—				
Quinine and quinine salts oz.	126,793	135,134	13,373	12,016
Proprietary medicines value	—	—	88,182	106,896
All other descriptions ,,	—	—	136,944	138,483
Dyes and dyestuffs and extracts for tanning—				
Finished dyestuffs from coal tar—				
Alizarine, alizarine red and indigo (synthetic) .. cwt.	1,921	479	14,046	3,855
Other sorts .. ,,	7,597	7,184	108,823	94,891
All other descriptions ,,	20,800	21,068	27,948	25,528
Painters' colours and materials—				
Ochres and earth colours cwt.	13,510	13,962	14,040	14,762
Other descriptions ,,	18,103	15,869	26,246	27,703
White lead .. ,,	5,807	8,379	10,134	18,045
Paints and painters' enamels, prepared cwt.	36,117	38,263	95,056	99,769
Varnish and lacquer (clear) .. .. gal.	65,558	63,972	24,421	24,984
Printers' ink .. ,,	4,091	3,401	24,926	21,220
All other descriptions ,,	41,543	41,896	76,408	89,019
Total .. value	—	—	1,779,061	1,922,499

Re-Exports

	Quantities. December 31, 1935.	Quantities. December 31, 1936.	Value. December, 31, 1935.	Value. December, 31, 1936.
Chemical manufactures and products .. value	—	—	35,440	16,563
Drugs, medicines and medicinal preparations—	—	—	11,777	8,712
Dyes and dyestuffs and extracts for tanning cwt.	638	2,136	1,196	6,698
Painters' colours and materials .. cwt.	576	3,198	1,444	2,426
Total .. value	—	—	49,857	34,399

Personal Notes

VISCOUNT LEVERHULME, president of the Society of Chemical Industry and past president of the Institution of Chemical Engineers, was married at St. Ethelburga's, Bishopsgate, London, on Wednesday, to Mrs. Winifred A. L. Morris, daughter of Lieut.-Colonel and Mrs. J. E. Lloyd, of Brentwood, Bidston, Cheshire, Dr. W. F. Geikie-Cobb officiating. Before the church service the civil ceremony took place at Guildhall, before the Registrar, Mr. G. P. Murdock. Only immediate members of the family attended. The Hon. Philip Lever accompanied his father as best man. After the ceremony a family luncheon party was held at the Dorchester Hotel, and the bride and bridegroom left for the honeymoon which is being spent cruising abroad.

PROFESSOR J. B. S. HALDANE has been awarded the Legion of Honour by the French Government for his scientific services to France. Professor Haldane returned to London last week from Spain, where he had been advising the Madrid Government on the protection of civilians from gas.

SIR HERBERT S. H. HENN, of Kensington, chairman of Forster's Glass Co., and a director of United Glass Bottle Manufacturers, Ltd., left estate valued £42,493, with net personalty £42,163.

MR. J. N. DOUGHTY, second assistant of Sheffield Gas Co., has been appointed chemist to Dundee Corporation Gas Department out of 34 applicants for the post. Mr. Doughty is a native of Sheffield and a B.Sc. of Sheffield University. He was appointed to his post with the Sheffield Gas Co. in 1928. He is 36 years of age.

SIR JOHN T. CARGILL, chairman of the Burmah Oil Co., Ltd., and other companies, has been in ill-health for some time, and on the recommendation of his medical advisers he has decided to take a prolonged rest from all business and other activities. Sir John, who resides in Scotland, has for many years taken an active part in the development of the oil industry in Burma and Persia.

PROFESSOR DAVID ELLIS, of the chair of Bacteriology in the Royal Technical College, Glasgow, where he was also Superintendent of the Schools of Pharmacy and of Bakery, died on January 16. Born in South Wales 62 years ago he graduated B.Sc. from London University in 1896 and then taught for four years in schools in Wales and Yorkshire. In 1900 he went to Marburg University, Germany, where he was engaged on research work in bacteriological botany, graduating Ph.D. there two years later. For two years he taught in Dollar Academy, Scotland, and in 1904 was appointed lecturer in botany and bacteriology in the Royal Technical College, Glasgow, becoming Professor in 1925, when he also was made Superintendent of the Schools of Pharmacy and Bakery. An authority on iron and sulphur bacteria and on sewage disposal, Professor Ellis was frequently consulted by local authorities in Scotland and England and by the Scottish Department of Health. He wrote many articles for the scientific Press.

Chemical Notes from Foreign Sources

Roumania

A FUR DYEING WORKS has been established at Brasov.

A NEW GLUCOSE FACTORY has been built by the "Colentina" Co. in Galben, and is expected to be in operation in the course of the year.

Hungary

THE PRODUCTION OF TANNING MATERIALS in Hungary is to be undertaken by the Nasic combine.

THE ALUMINIUM WORKS AT CSEPEL, owned by the Manfred Weiss concern of Budapest, is to have its annual output increased from 120 to 240 wagons.

Italy

THE CIA MINERARIA ETIOPICA has been registered in Milan with a share capital of 20 million lira, one-half of which has been taken up by the Montecatini concern, while smaller holdings have been taken up by numerous industrial concerns, including Fiat, Pirelli, Monte Amiata and Egiziana Fosfati. The declared object of the concern is to investigate the mineral wealth of Italian possessions in East Africa.

Jugoslavia

THE STEY COMPANY, registered in Belgrade with a capital of 500,000 dinar, will be engaged in the manufacture of chemical and pharmaceutical products.

TENDERS ARE BEING INVITED up till February 6 for 1,835 kg. of hexachlorethane and 1,835 kg. of zinc powder required by the Military Techincal Works "Obilicevo," near Krusevac.

Japan

A FACTORY FOR MAKING COLLOIDAL SULPHUR by a special process will be built at Nishiarai by the Japanese Colloid Chemical Industry Co. (capital 150,000 yen).

Germany

THE DEUTSCHE BERGIN A.G. FOR WOOD HYDROLYSIS, of Heidelburg, is taking steps to raise its capital to 1.9 million marks. In September, 1936, the original capital of 150,000 marks was increased to 1.3 million marks.

Norway

A NEW ALUMINIUM CONCERN, the Aluminium Foredling A/S, has been established with a capital of 80,000 kronen.

EXPLOITATION OF THE EXTENSIVE PYRITES DEPOSITS at Grong is planned by the Norwegian Government. It is estimated that flotation treatment will result in an annual yield of 300,000 tons pyrites concentrate, 25,000 tons cupriferous ore and 15,000 tons zinc blende. The pyrites will be worked up directly to sulphur and copper and iron extracted from the residues.

Czechoslovakia

THE PRODUCTION OF CASEIN WOOL by the lanital process of the Snia Viscosa is under consideration by a group of dairy co-operatives.

WITH A VIEW TO EXTRACTING IONIUM and other radio-active materials from waste products of the Joachimsthal Radium Works, it is proposed to start investigations at the State Radiological Institute in Prague.

Inventions in the Chemical Industry

THE following information is prepared from the Official Patents Journal. Printed copies of Specifications accepted may be obtained from the Patent Office, 25 Southampton Buildings, London, W.C.2, at 1s. each. The numbers given under "Applications for Patents" are for reference in all correspondence up to the acceptance of the Complete Specification.

Specifications Open to Public Inspection

MANUFACTURE OF SULPHONIC ACIDS.—Soc. of Chemical Industry in Basle. July 8, 1935. 9635/36.

PROCESS FOR THE PRODUCTION OF CONCENTRATED SULPHUR DIOXIDE.—Metallges, A.-G. July 5, 1935. 14121/36.

STARCH PRODUCT and process of forming the same.—A. E. Staley Manufacturing Co. July 8, 1935. 16350/36.

PROCESS FOR RESOLVING SOLUTIONS OR LIQUID MIXTURES into their constituents by cooling and crystallisation.—Ges. Fur Linde's Eismaschinen, A.-G., and G. A. Krause. July 10, 1935. 17592/36.

SOLUBLE HALOGEN containing butadiene derivatives.—Marbo Products Corporation. July 9, 1935. 18051/36.

PURIFICATION OF NATURAL ORGANIC PRODUCTS.—Kodak, Ltd. July 10, 1935. 18439/36.

SYNTHETIC RESINS and compositions containing such resins.—British Celanese, Ltd. July 6, 1935. 18462/36.

APPARATUS FOR THE DETERMINATION AND/OR REGULATION OF THE FAT CONTENT IN MILK.—Bergedorfer Eisenwerk, A.-G. Astra-Werke. July 5, 1935. 18486/36.

MANUFACTURE OF AMINE OXIDES.—Soc. of Chemical Industry in Basle. July 6, 1935. 18503/36.

PROCESS FOR THE MANUFACTURE OF RESINOUS CONDENSATION PRODUCTS.—Beck, Koller and Co. (England), Ltd. July 6, 1935. 18744/36.

MANUFACTURE OF DYES.—Kodak, Ltd. July 5, 1935. 18756/36.

MANUFACTURE OF INDIGOID DYESTUFFS.—Soc. of Chemical Industry in Basle. July 10, 1935. 19165/36.

Specifications Accepted with Date of Application

PRODUCTION OF HYDROCARBON PRODUCTS by the destructive hydrogenation of solid carbonaceous materials.—H. E. Potts. (International Hydrogenation Patents Co., Ltd.). April 5, 1935. 459,268.

TREATMENT WITH HYDROGENATING GASES of carbonaceous materials.—W. H. Beeston (International Hydrogenation Patents Co., Ltd.). June 1, 1935. 459,232.

MANUFACTURE OF ANHYDROUS FERRIC SULPHATE.—W. W. Groves (Monsanto Chemical Co.). June 4, 1935. 459,436.

METHOD OF MANUFACTURE OF PRECIPITATED ZINC OXIDE.—G. Antonoff. June 5, 1935. 459,238.

MANUFACTURE OF DISAND TRISAZO DYESTUFFS.—Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased)). (I. G. Farbenindustrie.) July 2, 1935. 459,441.

EXTRACTION OF TWO OR MORE LIQUID MIXTURES.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. July 14, 1934. 459,442.

NITRATION PROCESSES.—W. W. Groves (Deutschen Celluloid-Fabrik). July 4, 1935. 459,445.

MANUFACTURE OF LACQUERS or varnishes.—I. G. Farbenindustrie. July 6, 1934. 459,298.

PROCESS FOR THE MANUFACTURE OF CONDENSATION PRODUCTS containing nitrogen.—A. Carpmael (I. G. Farbenindustrie). July 6, 1935. 459,453.

MANUFACTURE OF SHEETS FROM POLYVINYL CHLORIDE or the like.—W. W. Groves (Deutschen Celluloid-Fabrik.) July 8, 1935. 459,514.

MANUFACTURE OF PLASTIC MASSES.—I. G. Farbenindustrie. July 7, 1934. 459,515.

PREPARATION OF PHOSPHORIC ACID ESTERS of aliphatic alcohols.—W. J. Tennant (Victor Chemical Works). July 8, 1935. 450,520.

MANUFACTURE OF PREPARATIONS CONTAINING VITAMIN.—I. G. Farbenindustrie. July 12, 1934. 459,524.

REFINING OF NATURAL WAXES.—E. W. Fawcett, and Imperial Chemical Industries, Ltd. July 10, 1935. 459,540.

MANUFACTURE OF INSECTICIDAL PRODUCTS from pyrethrum flowers.—E. W. Fawcett, and Imperial Chemical Industries, Ltd. July 10, 1935. 459,541.

COLUMNS CONTAINING FILLER BODIES and adapted for distributing liquids passing therethrough.—Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased)). (I. G. Farbenindustrie.) July 11, 1935. 459,542.

MANUFACTURE AND PRODUCTION OF QUATERNARY AMMONIUM BASES.—Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased)). (I. G. Farbenindustrie.) July 11, 1935. 459,309.

PURIFICATION OF TRICRESYL PHOSPHATE used for the extraction of phenols.—Coutts and Co., and F. Johnson (Legal representatives of J. Y. Johnson (deceased)). (I. G. Farbenindustrie.) July 15, 1935. 459,310.

PROCESS FOR THE MANUFACTURE OF RESINOUS CONDENSATION PRODUCTS.—Beck, Koller and Co. (England), Ltd. July 17, 1934. 459,549.

COKE-OVEN GAS BY-PRODUCT RECOVERY.—L. Mellersh-Jackson. (Koppers Co. of Delaware). July 17, 1935. 459,311.

WORKING UP OF MATERIALS CONTAINING MOLYBDENUM or tungsten.—H. E. Potts (International Hydrogenation Patents Co., Ltd.). August 24, 1935. 459,554.

SEED DISINFECTANT COMPOSITIONS.—Schering-Kahlbaum, A.-G. September 28, 1934. 459,318.

MANUFACTURE OF ORGANIC MERCURY COMPOUNDS.—Schering-Kahlbaum, A.-G. September 29, 1934. 459,462.

Applications for Patents

(December 31 to January 6.)

PREPARATION OF DISUBSTITUTED BARBITURIC ACIDS.—E. Lilly and Co., and H. A. Shonte. 34128.

MANUFACTURE OF BUTYL ALCOHOL, ETC.—J. F. Loughlin. (United States, Dec. 23, '35.) 34593.

PRODUCTION OF POLYMERISATION PRODUCTS of tertiary olefines. Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. (United States, Dec. 23, '35.) 34474.

DEHYDRATION OF ORGANIC OXY-COMPOUNDS.—Naamlooze Vennootschap de Bataafsche Petroleum Maatschappij. (United States, Dec. 23, '35.) 34636.

PRODUCTION OF HYDROGEN PEROXIDE.—Naamlooze Vennootschap Industrieele Maatschappij voorheen Noury and Van der Lande. (Holland, Dec. 21, '35.) 33991.

TREATMENT OF LIQUID, ETC., CARBONACEOUS MATERIALS.—H. E. Potts (International Hydrogenation Patents Co., Ltd.). 34364.

PURIFICATION OF GASES.—Ruhrgas, A.-G. (Germany, Dec. 16.) 34627.

PRODUCTION OF NITRIC ACID.—W. Rudbach. 34288.

MANUFACTURE OF HYDROCHLORIC ACID from calcium chloride.—Soc. Internationale des Industries Chimiques et Dérivés Soc. Anon. 34383.

BITUMINOUS MATERIALS.—Standard Oil Development Co. (United States, Feb. 27.) 34073.

REFINING OF OILS.—Standard Oil Development Co. (United States, Jan. 2.) 34416.

ACETYLATION PROCESS for cellulose fibres, etc.—A. C. Thaysen. 34254.

MANUFACTURE OF COMPOUNDS of the type of oestradiol esterified in 3-position.—A. G. Bloxam (Soc. of Chemical Industry in Basle). 193.

MANUFACTURE OF COMPOUNDS of the oestrin series.—A. G. Bloxam (Soc. of Chemical Industry in Basle). 194.

FILTERS.—Bozec et Gautier. (France, Jan. 6, '36.) 73

MANUFACTURE OF CELLULOSIC PELLICLES.—British Cellophane, Ltd. 89.

REDUCTION OF THE INFLAMMABILITY OF PETROL, ETC.—E. A. Buckle. 1.

MANUFACTURE OF PHTHALOCYANINES.—A. Carpmael (I. G. Farbenindustrie). 79.

MANUFACTURE OF ZINC CHLORIDE-SODIUM CHLORIDE MIXTURES.—A. Carpmael (I. G. Farbenindustrie). 131.

TREATMENT OF ORGANIC MATERIALS.—H. Dreyfus. 397.

MANUFACTURE OF ORGANIC COMPOUNDS.—H. Dreyfus. 398.

MANUFACTURE OF ISOQUINOLINE COMPOUNDS, ETC.—W. W. Groves. 195.

MANUFACTURE OF PHYSIOLOGICALLY-ACTIVE PREPARATIONS.—W. W. Groves. 307.

PREPARATION OF LACTONES.—L. Mellersh-Jackson (Givaudan et Cie, Soc. Anon., L.). 239.

MANUFACTURE OF AZO DYESTUFFS.—G. W. Johnson (I. G. Farbenindustrie). 203.

APPARATUS FOR SOFTENING WATER.—E. P. M. Lavech. (Belgium, Jan. 9, '36.) 406.

GERMICIDAL PREPARATIONS.—Lehn and Fink Products Corporation. (United States, Jan. 8, '36.) 122.

ATOMISING DEVICES.—Mather and Platt, Ltd. (Loepsinger). 369.

PRODUCTION OF HYDROGEN-CONTAINING GASES.—National Coke and Oil Co., Ltd., and J. L. Strevens. 251.

SULPHONIC ACIDS, ETC.—Soc. Anon. des Matières Colorantes et Produits Chimiques de St.-Denis, M. Paillard and A. Wahl. (France, Jan. 6, '36.) 386.

SPRING BALANCES.—Suffolk Iron Foundry (1920), Ltd. 133.

POLYMERISATION OF HALOGEN BUTADIENES.—W. W. Triggs (E. I. du Pont de Nemours and Co.). 173.

OPERATION, ETC., OF WATER-FILTERING SYSTEMS.—United Water Softeners, Ltd. (United States, Jan. 2, '36.) 142.

WET-TREATING AND DRYING SPUN ARTIFICIAL SILK FILAMENTS.—Vereinigte Glanzstoff-Fabriken A.-G. (Germany, Jan. 9, '36.) 33.

DRYING PROCESS.—Dr. A. Wacker Ges für Elektrochemische Industrie. (Germany, Jan. 20, '36.) 387.

New Companies Registered

Consoil Lubricants, Ltd., 47 Blackett Street, Newcastle-on-Tyne. Registered December 30. Nominal capital £2,000. Manufacturers, refiners, blenders and importers of and dealers in oils and oleaginous compounds and emulsions, etc. Directors: Thomas H. H. Connell and H. R. Connell.

J. W. Hockley, Ltd., 170 Bishopsgate, E.C.2.—Registered January 7. Nominal capital, £500. Druggists' merchants, manufacturers of and wholesale and retail dealers in chemicals, gases and disinfectants, etc. Subscribers: Donald A. Sincock and R. J. Cracknell.

Domestos, Ltd.—Registered December 30. Nominal capital £5,000. To acquire the business of a chemical manufacturer and merchant now carried on by Wilfrid A. Handley, at Newcastle-on-Tyne and elsewhere, as the "Hygienic Disinfectant Service." Subscribers: Wilfrid A. Handley, Reka-Dom, Valley Drive, Gateshead-on-Tyne, and Mrs. I. I. C. Handley.

N. Carew-Fisher and Son, Ltd.—Registered January 8. Nominal capital, £1,000. Manufacturers, extractors, distillers and refiners of cod-liver, halibut, turtle, coconut, olive, pine, clove, almond, eucalyptus, caraway, sandalwood, spike, jasmin, lavender and other oils, etc. Subscribers: Niels Carew-Fisher, Godolphin House, Penzance, and St. John H. Carew-Fisher.

Progessive Manufacturing Co.—Registered December 30. Nominal capital £1,500. Manfuacturers of boot and shoe dressings and finishes, polishes, chemical preparations, synthetic resins and tanning materials, distempers and paints, manufacturers of and dealers in leather finishes, dyes, waxes, soap, oils, etc. Directors: J. W. R. Heggs, 148 Cedar Road East, Northampton, and A. Dickens.

Allied Laboratories, Ltd., King William Street House, Arthur Street, E.C.3.—Registered January 7. Nominal capital, £1,000. Manufacturers of and dealers in chemicals, gases, drugs, medicines, gypsum, plasters, disinfectants, fertilisers, paints, oils, colours, etc., and to adopt an agreement with H. E. Heitz for the purchase of certain assets. Subscribers: George P. Saunders and S. S. Gibbons.

Cornish Fish Products (London), Ltd., 16 Eastcheap, E.C.—Registered January 6. Nominal capital, £5,000. Manufacturers of fish products, manures, meals, oils and fertilisers and other fish compounds, cod liver and other oils, feeding meals and stuffs, condiments, sheep dips, disinfectants, offals, insecticides, hop and fruit tree washes, etc. Directors: Robert A. G. Tilney, S. A. Cohen, F. H. Small, D. J. Ferguson, and G. W. Fenton.

Modern Mouldings, Ltd., 10 Finsbury Square, E.C.2.—Registered January 14. Nominal capital, £1,000. Moulders in plastic and synthetic resin, etc. Subscribers: Frank H. Nixon and G. H. Nixon.

Hertfordshire Bronze Powder Works, Ltd.—Registered January 6. Nominal capital, £10,000. Manufacturers and sellers of and dealers in metallic powder and foils, etc. Subscribers: J. G. Beevor, 18 Austin Friars, E.C.2, and E. C. Brydges.

K. T. O. Patents, Ltd., 36 New Broad Street, E.C.—Registered January 1. Nominal capital £6,000. To acquire certain patents for an invention relating to a tunnel oven process for the carbonisation of bituminous materials and to adopt an agreement with M. Kulzinsky. Subscribers: W. Rosier and C. H. Treble.

Pharmacie, Ltd.—Registered January 16. Nominal capital £2,000. Manufacturers, importers and exporters of and dealers in toilet preparations and specialities, hair foods, hair restorers, soap, perfumes, etc. Subscribers: A. C. Dowsing, 186 Popes Lane, Ealing, W.5, and A. K. Sterne.

Malta Fish Canning and Oil Refineries, Ltd.—Registered January 15. Nominal capital, £1,000. Fish canners, oil refiners, seed crushers, manufacturers of soap and kindred commodities, oil cakes, etc. Directors: Olof F. Gollcher, The Norman House, L'Undina, Malta, and T. R. U. Basset.

Matt. Outhwaite (Coal and By-Products), Ltd.—Registered January 14. Nominal capital, £1,000. Merchants, manufacturers of and dealers in coal, patent fuel, briquettes, coke, peat, and all by-products which can be produced by the treatment of coal; dye and colour makers, etc. Subscribers: Matthew Outhwaite, 1 Carlton Road, Burnley, and Mrs. Outhwaite.

Formulas (Leeds), Ltd., Brunel Buildings, 7 Brunel Street, Armley Road, Leeds.—Nominal capital, £2,000. Manufacturers of and dealers in laundry and other soap and washing materials, oils, greases, perfumes, oleaginous and saponaceous substances, etc. Directors: Wesley Clarkson and R. W. Clarkson.

Sussex Products Co., Ltd., Alexandra Works, Terrace Road, St. Leonards-on-Sea. — Registered December 22. Nominal capital £2,500. To acquire the business of experimental research and other work carried on by C. F. Button, at Alexandra Works, Terrace Road, St. Leonards-on-Sea, and to carry on the business of essential oil merchants and distillers, manufacturers, importers and exporters of essential oils, fruit oils and essences, raw materials and root products, etc. Directors: Thomas J. McArthur and C. W. Moat.

Chemical and Allied Stocks and Shares

WITH the exception of British Government stocks, which were easier on the view expressed in some quarters that money rates may show a tendency to become dearer during the next twelve months, most sections of the stock and share markets were firm this week. Shares of companies operating in the chemical and kindred industries were active and developed numerous features of interest. Triplex Safety Glass were prominent owing to the bonus proposed by the directors. There was some profit-taking following the announcement of the proposals, but at 183s. 9d., the price at the time of writing shows a substantial rise on balance for the week. Particular interest also attached to the official statement that developments now being undertaken by H. E. Ashdown (Birmingham), a subsidiary which produces plastics, are such that it will require substantial additional capital.

Murex were also higher on the official statement confirming the bonus announced in the report last October. The company then issued additional shares to shareholders at a price considerably below the market value, and a free share bonus is to be distributed now the new shares are fully paid. British Oxygen was another share in active demand. In this case there are confident market anticipations that a favourable increase in dividend can be expected. The 4s. ordinary shares of British Glues and Chemicals continued in larger demand and have now risen sharply to 11s. 6d. Pinchin Johnson have reacted from 55s. 9d. to 54s. 6d., but current anticipations are that either a scrip bonus or a larger dividend can be anticipated. Most other paint shares continued to show a steady tendency.

Cement shares were more prominent, particularly Alpha Cement, which responded to hopes that the impending results will show a larger dividend despite the increased capital in issue. Tunnel Portland Cement, whose results can also be expected next month, were firm and Eastwoods Cement benefited from attention drawn to the possibility that a bigger interim dividend may be declared in a few weeks.

Imperial Chemical were lower at 40s. 6d., compared with 41s. 6d., and Courtaulds were little changed. The shares of these companies are first class industrials, but at the present time they are not among shares on which market interest is centred. This is because it is expected the directors will continue to follow a very conservative policy and consequently, although profits may very well show a favourable increase, the disposition is not to look for larger dividend payments this year. Salt Union remained steady at 45s. Borax Consolidated reacted at one time, but recovered later, and at 36s. are unchanged on the week. General Refractories ordinary shares continued steady on anticipations that the dividend will be maintained on the larger capital ranking. International Diatomite 5s. shares were steady at 7s.

Boots Pure Drug 5s. shares were prominently active on continued talk of a bonus and are higher at 62s. 9d. The company makes its accounts up to the end of March and they fall to be issued in June. Timothy Whites and Taylors 5s. shares were moderately higher at 34s. 2d., and Sangers 5s. shares were little changed at 27s. 9d.

Unilever came in for moderate profit-taking following their recent rise, as did United Molasses, but the latter were in renewed demand later. Distillers were better, partly owing to the statements at the meeting of Petroleum Storage and Finance as to the success of "Cleveland Discol" the petrol-alcohol blend of motor spirit produced by the Distillers Co.

Richard Thomas were again moderately lower on the new issue, although the full terms of the latter created a good impression. Colvilles were better on current dividend estimates, and Consett Iron again made a higher price. Staveley Coal and Iron were more active on the possibility of a bigger interim dividend. Swedish Match "B" shares improved on hopes that the company's earnings are recovering. Among textile shares there was demand for the preference shares of Bleachers and Calico Printers. "Shell" and other oil shares continued steady under the influence of the rise in the price of petrol.

Weekly Prices of British Chemical Products

PRICES of a number of rubber chemicals have increased during the week, notably cadmium sulphide, which has risen from 4s. 3d.-4s. 5d. to 4s. 9d.-5s. per lb. Wood distillation products have shown a tendency to decrease, methyl acetone having dropped by £2 per ton. There have also been slight variations in the coal tar products section, pharmaceutical and photographic chemicals, and intermediates and dyes. There are no noteworthy price changes to report in the market for heavy chemicals. Unless otherwise stated the prices below cover fair quantities net and naked at sellers' works.

MANCHESTER.—General steady price conditions have obtained on the Manchester chemical market during the past week and in few instances has any reactionary tendency made its appearance. Inquiry on export account locally has been on a moderate scale, much of it being in respect of the coal tar products. In the case of heavy chemicals, there has been a fair movement on home consumption account, particularly in the heavy acids and the alkalies, with the cotton and woollen textile industries taking relatively good deliveries against contracts, most of which are being steadily drawn against. A moderate amount of business has been reported for near delivery positions. Among the by-products pitch shows little or no improvement, but in cresylic acid and the toluols and a number of other lines good quantities are being taken up and prices are firm on a shortage of open market supplies.

GLASGOW.—There has been an improved demand for chemicals for home trade during the week, and also rather more inquiry for export. Prices generally continue firm at about previous figures, and lead and copper products are again dearer, on account of higher metal prices. Sulphate of copper is now £20 5s. per ton, less 5 per cent., compared with £19 15s. last week. Conditions in the coal tar products market continue very steady. There has been a definite move in the direction of more forward buying of cresylic acid, and supplies fail still to meet the demand. Carbolic is active and more attention is being given also to high boiling fractions. Creosote is leaving manufacturers' hands in regular consignments against existing contracts. The lighter fractions of pyridine show a further advance in price. Crude benzol is about normal, while naphthas appear comparatively quiet. Apart from small home consignments, pitch remains dull.

Price Changes

Rubber Chemicals.—CADMIUM SULPHIDE, 4s. 9d. to 5s. per lb.; INDIA-RUBBER SUBSTITUTES, white, 4½d. to 5d.; dark, 3¾d. to 4¼d.; LITHOPONE, 30%, £16 5s. to £17 per ton.

Wood Distillation Products.—METHYL ACETONE, 40/50%, £43 to £46 per ton; WOOD CREOSOTE, unrefined, 6d. to 9d. per gal.; WOOD NAPHTHA, miscible, 2s. 6d. to 3s. 3d.; solvent, 3s. 3d. to 3s. 6d.

Coal Tar Products.—NAPHTHA, solvent 90/190, 1s. 1d. to 1s. 2d. per gal.; NAPHTHALENE, purified crystals, £18-£20 per ton; PYRIDINE, 90/180, 2s. 6d. per gal.

Pharmaceutical and Photographic Chemicals.—AMMONIUM BENZOATE, 3s. 6d. per lb.; CALCIUM LACTATE, B.P., 1s. to 1s. 8d.; EPHEDRINE HYDROCHLORIDE, 5s. 3d. per oz.; IRON QUININE CITRATE, B.P., 1s. 1d.; LITHIUM CHLORIDE, cryst., 9s. 6d. per lb.; LITHIUM CITRATE, 5s. 10d.; SALICIN, 12s.; SODIUM BARBITONE, 12s. 9d.

Intermediates and Dyes.—DICHLORANILINE, 2s. 3d. per lb.; DINITROBENZENE, 7½d.; DINITROLUENE 48/50° C., 8½d.; DINITROTOLUENE, 66/68° C., 10d.; *p*-NITRANILINE, 2s. 1d.; NITROBENZENE, 5d.; NITRONAPHTHALENE, 9½d.; *o*-TOLUIDINE, 10½d.; *p*-TOLUIDINE, 1s. 10½d.

General Chemicals

ACETONE.—£62 to £65 per ton; SCOTLAND: £64 to £65 ex wharf, according to quantity.

ACID, ACETIC.—Tech., 80%, £30 5s. to £32 5s. per ton; pure 80%, £32 5s. to £34 5s.; tech., 40%, £16 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. SCOTLAND: Glacial 98/100%, £48 to £52; pure 80%, £32 5s.; tech., 80%, £30 5s., d/d buyers' premises Great Britain. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.

ACID, BORIC.—Commercial granulated, £27 per ton; crystal, £28; powdered, £29; extra finely powdered, £31; packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. B.P. cryst., £36; B.P. powder, £37. SCOTLAND: Crystals, in 1 cwt. bags, £28; powdered, in 1 cwt. bags, £29.

ACID, CHROMIC.—9¼d. per lb., less 2½%; d/d U.K.

ACID, CITRIC.—1s. per lb. MANCHESTER: 11¾d. SCOTLAND: B.B. crystals, 11¾d. to 1s. per lb., less 5%.

ACID, CRESYLIC.—97/99%, 3s. 2d. to 3s. 3d. per gal.; pale, 98%, 3s. 1d. to 3s. 2d.; dark, 2s. 6d. to 2s. 7d.; 99/100%, refined, 3s. 7d. to 3s. 9d. per gal. MANCHESTER: 99/100%, pale, 3s. 8d.

ACID, FORMIC.—85%, in carboys, ton lots, £42 to £47 per ton.

ACID, HYDROCHLORIC.—Spot, 4s. to 6s. carboy d/d according to purity, strength and locality. SCOTLAND: Arsenical quality, 4s.; dearsenicated, 5s. ex works, full wagon loads.

ACID, LACTIC.—LANCASHIRE: Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50: pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50% by vol., £41. One-ton lots ex works, barrels free.

ACID, NITRIC.—80° Tw. spot, £18 to £25 per ton makers' works. SCOTLAND: 80°, £24 ex station full truck loads.

ACID, OXALIC.—£48 15s. to £57 10s. per ton, according to packages and position. SCOTLAND: £2 9s. per cwt. in casks. MANCHESTER: £49 to £54 per ton ex store.

ACID, SULPHURIC.—SCOTLAND: 144° quality, £3 12s. 6d.; 168°, £7; dearsenicated, 20s. per ton extra.

ACID, TARTARIC.—11¾d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. SCOTLAND: 11⅞d. less 5%. MANCHESTER: 11¾d. to 1s. per lb.

ALUM.—SCOTLAND: Ground, £10 2s. 6d. per ton; lump, £9 12s. 6d.

ALUMINA SULPHATE.—LONDON: £7 10s. to £8 per ton. SCOTLAND: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 10d. per lb. d/d in cylinders. SCOTLAND: 10d. to 1s. containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM BICHROMATE.—8d. per lb. d/d U.K.

AMMONIUM CARBONATE.—SCOTLAND: Lump, £30 per ton; powdered, £33, in 5-cwt. casks d/d buyers' premises U.K.

AMMONIUM CHLORIDE.—LONDON: Fine white crystals, £18 to £19. (See also Salammoniac.)

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM SULPHATE.—Neutral quality. 20.6% nitrogen, £7 5s. per ton.

ANTIMONY OXIDE.—SCOTLAND: £61 to £65 per ton, c.i.f. U.K. ports.

ARSENIC.—LONDON: £13 10s. per ton c.i.f. main U.K. ports for imported material; Cornish nominal, £22 10s. f.o.r. mines. SCOTLAND: White powdered, £17 ex store. MANCHESTER: White powdered Cornish £17 10s. ex store.

BARIUM CHLORIDE.—£11 per ton.

BISULPHITE OF LIME.—£6 10s. per ton f.o.a. London.

BLEACHING POWDER.—Spot, 35/37%. £8 15s. per ton in casks, special terms for contracts. SCOTLAND: £9.

BORAX COMMERCIAL.—Granulated, £14 10s. per ton; crystal £15 10s.; powdered, £16; finely powdered, £17; packed in 1-cwt. bags, carriage paid home to buyer's premises within the United Kingdom in 1-ton lots SCOTLAND: Granulated, £14 10s. per ton in 1 cwt. bags, carriage paid.

CALCIUM CHLORIDE.—Solid 70/75% spot, £5 5s. per ton d/d station in drums. SCOTLAND: 70/75% solid, £5 10s. per ton net ex store.

CHROMETAN.—Crystals, 2¾d. per lb.; liquor, £19 10s. per ton d/d

COPPERAS (GREEN).—SCOTLAND: £3 15s. per ton, f.o.r. or ex works.

CREAM OF TARTAR.—£3 19s. per cwt. less 2½%. LONDON: £3 17s. per cwt. SCOTLAND: £3 19s. net.

DINITROTOLUENE.—66/68° C., 9d. per lb.

FORMALDEHYDE.—LONDON: £24 10s. per ton. SCOTLAND: 40% £25 to £28 ex store.

GLYCERINE.—Chemically pure, double distilled, 1,260 s.g., in tins £4 17s. 6d. to £5 17s. 6d. per cwt. according to quantity; in drums, £4 10s. to £5 3s. 6d.

IODINE.—Resublimed B.P., 5s. 1d. per lb.

LEAD ACETATE.—LONDON: White, £33 15s. per ton; brown, £1 per ton less. SCOTLAND: White crystals, £34 to £35; brown, £1 per ton less. MANCHESTER: White, £37, brown, £36.

LEAD NITRATE.—£32 10s. to £34 10s. per ton.

LEAD, RED.—SCOTLAND: £41 per ton less 2½%, carriage paid, for 2-ton lots.

LEAD, WHITE.—SCOTLAND: £41 per ton, carriage paid. LONDON: £41.

MAGNESITE.—SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—SCOTLAND: £7 per ton.

MAGNESIUM SULPHATE.—Commercial, £5 per ton, ex wharf.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O P., 1s. 9d. to 2s. 4d.

PARAFFIN WAX.—SCOTLAND: 3⅜d. per lb.

PHENOL.—6¾d. to 7⅛d. per lb.

POTASH, CAUSTIC.—LONDON: £42 per ton. MANCHESTER: £39 10s.

POTASSIUM BICHROMATE.—SCOTLAND: 5d. per lb., less 5%, carriage paid.

POTASSIUM CHLORATE.—LONDON: £37 to £40 per ton. SCOTLAND: 4¼d. per lb. MANCHESTER: £38 per ton.

Potassium Chromate.—6½d. per lb. d/d U.K.
Potassium Iodide.—B.P. 4s. 3d. per lb.
Potassium Nitrate.—**Scotland**: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.
Potassium Permanganate.—**London**: 8¼d. per lb. **Scotland**: B.P. Crystals, 9½d. **Manchester**: B.P. 10¾d. to 11¼d.
Potassium Prussate.—**London**: Yellow, 7½d. to 8d. per lb. **Scotland**: 7d. net, in casks, ex store. **Manchester**: Yellow, 6¼d.
Salammoniac.—First lump spot, £41 17s. 6d. per ton d/d in barrels. **Scotland**: Large crystals, in casks, £37 10s.
Soda Ash.—58% spot, £5 12s. 6d. per ton f.o.r. in bags.
Soda, Caustic.—Solid, 76/77° spot, £13 17s. 6d. per ton d/d station. **Scotland**: Powdered 98/99%, £17 10s. in drums, £18 5s. in casks, Solid 76/77°, £14 12s. 6d. in drums; 70/73%, £14 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts 10s. per ton less. **Manchester**: £13 5s. to £14 contracts.
Soda Crystals.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.
Sodium Acetate.—**London**: £21 per ton. **Scotland**: £19 per ton net ex store.
Sodium Bicarbonate.—Refined spot, £10 10s. per ton d/d station in bags. **Scotland**: £12 10s. per ton in 1 cwt. kegs, £10 15s. per ton in 2 cwt. bags. **Manchester**: £10 10s.
Sodium Bichromate.—Crystals cake and powder 4d. per lb. net d/d U.K. discount 5%. Anhydrous, 5d. per lb. **London**: 4d. per lb. less 5% for spot lots and 4d. per lb. with discounts for contract quantities. **Manchester**: 4d. per lb. **Scotland**: 4d., less 5% carriage paid.
Sodium Bisulphite Powder.—60/62%, £20 per ton d/d 1 cwt. iron drums for home trade.
Sodium Carbonate, Monohydrate.—£15 per ton d/d in minimum ton lots in 2 cwt. free bags. Soda crystals, **Scotland**: £5 to £5 5s. per ton ex quay or station. Powdered or pea quality, 7s. 6d. per ton extra. Light Soda Ash, £7 ex quay, min. 4-ton lots with reductions for contracts.
Sodium Chlorate.—£29 per ton. **Scotland**: £1 10s. per cwt.
Sodium Chromate.—4d. per lb. d/d U.K.
Sodium Hyposulphite.—**Scotland**: Large crystals English manufacture, £9 5s. per ton ex stations, min. 4-ton lots. Pea crystals, £14 10s. ex station, 4-ton lots. **Manchester**: Commercial, £10; photographic, £14 10s.
Sodium Sulphite.—Pea crystals, spot, £13 5s. per ton d/d station in kegs. Commercial spot, £8 15s. d/d station in bags.
Sulphate of Copper.—**Manchester**: £19 10s. per ton f.o.b. **Scotland**: £20 5s. per ton less 5% in casks.
Sulphur Precip.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.
Zinc Chloride.—**Scotland**: British material, 98%, £18 10s. per ton f.o.b. U.K. ports.
Zinc Sulphate.—**London**: £12 per ton. **Scotland**: £10 10s.

Rubber Chemicals

Antimony Sulphide.—Golden, 6½d. to 1s. 1d. per lb., according to quality. Crimson, 1s. 5½d. to 1s. 7d. per lb., according to quality.
Arsenic Sulphide.—Yellow, 1s. 5d. to 1s. 7d. per lb.
Barytes.—£6 to £7 10s. per ton, according to quality.
Cadmium Sulphide.—4s. 9d. to 5s. per lb.
Carbon Bisulphide.—£31 to £33 per ton, according to quantity, drums extra.
Carbon Black.—3 11/16d. to 4 13/16d. per lb., ex wharf.
Carbon Tetrachloride.—£41 to £46 per ton, according to quantity, drums extra.
Chromium Oxide.—Green, 1s. 2d. per lb.
Diphenylguanidine.—2s. 2d. per lb.
India-rubber Substitutes.—White, 4½d. to 5d. per lb.; dark, 3¾d. to 4¼d. per lb.
Lamp Black.—£22 to £23 per ton.
Lead Hyposulphite.—9d. per lb.
Lithopone.—30%, £16 5s. to £17 per ton.
Sulphur.—£9 to £9 5s. per ton. **Sulphur precip.** B.P., £55 to £60 per ton. **Sulphur precip. comm.**, £50 to £55 per ton.
Sulphur Chloride.—5d. to 7d. per lb., according to quantity.
Vermillion.—Pale, or deep, 5s. 1d. per lb., 1-cwt. lots.
Zinc Sulphide.—10d. to 11d. per lb., according to quality.

Nitrogen Fertilisers

Sulphate of Ammonia.—Neutral quality, basis 20.6 per cent. nitrogen, delivered in 6-ton lots to farmer's nearest station, January, £7 2s. per ton; February, £7 3s. 6d. per ton; March to June, £7 5s. per ton.
Calcium Cyanamide.—January, £7 1s. 3d. per ton; February, £7 2s. 6d. per ton; March, £7 3s. 9d. per ton; April to June, £7 5s. per ton, carriage paid to any railway station in Great Britain in lots of four tons and over.
Nitro-Chalk.—£7 5s. per ton for delivery to end of June.
Nitrate of Soda.—£7 12s. 6d. per ton for delivery up to end of June.
Concentrated Complete Fertilisers.—£10 12s. to £11 1s. per ton for delivery up to end of June, delivered in 6-ton lots to farmer's nearest station.
Ammonium Phosphate Fertilisers.—£10 5s. to £13 15s. per ton for delivery up to end of June, delivered in 6-ton lots to farmer's nearest station.

Coal Tar Products

Acid, Cresylic.—97/99%, 3s. 2d. to 3s. 3d. per gal.; 99/100%, 3s. 6d. to 4s. per gal., according to specification; pale 99%, 3s. 4d. to 3s. 5d.; dark, 2s. 9d. to 2s. 10d. **Glasgow**: Pale, 99/100%, 3s. to 3s. 6d. per gal.; pale, 97/99%, 2s. 8d. to 3s. dark, 97/99%, 2s. 5d. to 2s. 8d.; high boiling acids, 1s. 8d. to 2s.; American specification, 2s. 9d. to 3s. 3d.
Acid, Carbolic.—Crystals, 6¾d. to 7¼d. per lb.; crude, 60's, 2s. 7d. to 2s. 9d. per gal. **Manchester**: Crystals, 6¾d. to 7d. per lb.; crude, 2s. 8d. per gal. **Glasgow**: Crude, 60's, 2s. 6d. to 2s. 9d. per gal.; distilled, 60's, 2s. 9d. to 3s. 3d.
Benzol.—At works, crude, 8½d. to 9d. per gal.; standard motor 1s. 2d. to 1s. 2½d.; 90%, 1s. 3d. to 1s. 3½d.; pure, 1s. 7d. to 1s. 7½d. **London**: Motor, 1s. 3½d. **Glasgow**: Crude, 9d. to 10d. per gal.; motor, 1s. 2d. to 1s. 3d.
Creosote.—B.S.I. Specification standard, 5¾d. to 6d. per gal. f.o.r. Home, 3¾d. d/d. **London**: 4½d. f.o.r. North: 5d. London. **Manchester**: 5½d. to 5¾d. **Glasgow**: B.S.I. Specification 5½d. to 5¾d. per gal.; washed oil, 4¾d. to 5¼d.; lower sp. gr. oils, 5d. to 5¼d.
Naphtha.—Solvent, 90/160%, 1s. 6d. to 1s. 7d. per gal.; 95/160%, 1s. 7d.; 90/190%, 1s. 1d. to 1s. 2d. **London**: Solvent, 1s. 3½d. to 1s. 4d.; heavy, 11d. to 1s. 0½d. f.o.r. **Glasgow**: Crude, 5½d. to 6d. per gal.; 90% 160, 1s. 3d. to 1s. 4d.; 90% 190, 1s. to 1s. 1d.
Naphthalene.—Crude, whizzed or hot pressed, £12 to £13 per ton; purified crystals, £18 to £20 per ton in 2-cwt. bags. **London**: Fire lighter quality, £5 to £5 10s. per ton; crystals, £27 to £27 10s. **Glasgow**: Fire lighter, crude, £7 to £7 10s. per ton (bags free).
Pyridine.—90/140%, 8s. to 9s. 6d. per gal.; 90/180, 2s. 6d. **Glasgow**: 90% 140, 9s. to 10s. per gal.; 90% 160, 7s. to 8s.; 90% 180, 2s. 6d.
Toluole.—90%, 2s. per gal.; pure, 2s. 5d. **Glasgow**: 90%, 120, 1s. 10d. to 1s. 11d. per gal.
Pitch.—Medium, soft, 34s. per ton, in bulk at makers' works. **Manchester**: 32s. 6d. f.o.b., East Coast. **Glasgow**: f.o.b. Glasgow, 28s. 6d. to 35s. per ton; in bulk for home trade, 32s. 6d.
Xylol.—Commercial, 2s. 1d. per gal.; pure, 2s. 3d. **Glasgow**: Commercial, 1s. 11d. to 2s. per gal.

Wood Distillation Products

Acetate of Lime.—Brown, £8 10s. to £9 per ton; grey, £10 10s. to £11. Liquor, brown, 30° Tw., 6d. to 8d. per gal. **Manchester**: Brown, £9 10s.; grey, £11 10s.
Charcoal.—£5 5s. to £10 per ton, according to grade and locality.
Methyl Acetone.—40-50%, £43 to £46 per ton.
Wood Creosote.—Unrefined 6d. to 9d. per gal., according to boiling range.
Wood, Naphtha, Miscible.—2s. 6d. to 3s. 3d. per gal.; solvent, 3s. 3d. to 3s. 6d. per gal.
Wood Tar.—£2 to £3 per ton.

Intermediates and Dyes

Acid, Benzoic, 1914 B.P. (ex toluol).—1s. 9½d. per lb. d/d buyer's works.
Acid, Gamma.—Spot, 4s. per lb. 100% d/d buyer's works.
Acid, H.—Spot, 2s. 4½d. per lb. 100% d/d buyer's works.
Acid Naphthionic.—1s. 8d. per lb.
Acid, Neville and Winther.—Spot, 3s. per lb. 100%.
Acid, Sulphanilic.—Spot, 8d. per lb. 100%, d/d buyer's works.
Aniline Oil.—Spot, 8d. per lb., drums extra, d/d buyer's works.
Aniline Salts.—Spot, 8d. per lb. d/d buyer's works, casks free.
Benzidine, HCl.—2s. 5d. per lb., 100% as base, in casks.
m-**Cresol** 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.
o-**Cresel** 30/31° C.—6½d. to 7½d. per lb. in 1-ton lots.
p-**Cresol** 34-5° C.—1s. 7d. to 1s. 8d. per lb. in ton lots.
Dichloraniline.—2s. 3d. per lb.
Dimethylaniline.—Spot, 1s. 6d. per lb., package extra.
Dinitrobenzene.—7½d. per lb.
Dinitrochlorbenzene, Solid.—£72 per ton.
Dinitrotoluene.—48/50° C., 8½d. per lb.; 66/68° C., 10d.
Diphenylamine.—Spot, 2s. per lb., d/d buyer's works.
α-Naphthol.—Spot, 2s. 4d. per lb., d/d buyer's works.
β-Naphthol.—In bags, £88 15s. per ton; in casks, £89 15s.
α-**Naphthylamine.**—Lumps, 1s. per lb.; ground, 1s. 0½d. in casks.
β-**Naphthylamine.**—Spot, 2s. 9d. per lb., d/d buyer's works in casks.
o-**Nitraniline.**—3s. 11d. per lb.
m-**Nitraniline.**—Spot, 2s. 7d. per lb., d/d buyer's works.
p-**Nitraniline.**—Spot, 2s. 1d. per lb. d/d buyer's works.
Nitrobenzene.—Spot, 5d. per lb., in 90-gal. drums, drums extra. 1-ton lots d/d buyer's works.
Nitronaphthalene.—9d. per lb.; P.G., 1s. 0½d. per lb.
Sodium Naphthionate.—Spot, 1s. 9d. per lb., 100% d/d buyer's works.
o-**Toluidine.**—10½d. per lb., in 8/10-cwt. drums, drums extra.
p-**Toluidine.**—1s. 10½d. per lb., in casks.
m-**Xylidine Acetate.**—4s. 3d. per lb., 100%.

From Week to Week

THE NAME of Hoffman-La Roche Chemical Works, Ltd., 51 Bowes Road, N.13, has been changed to Roche Products, Ltd.

THE BOARD OF TRADE JOURNAL for January 14 contains a special supplement relating to the Customs Tariff and Valuations for British India.

THE TREASURY HAS MADE AN order under Section 10(5) of the Finance Act, 1926, exempting N-(Oxy-aceto-mercuric-propyl) -ethyl-urethane from Key Industry Duty from January 23 until December 31. The Treasury order will shortly be published by H.M. Stationery Office.

OWING TO ALTERATIONS in the London Telephone Service, the telephone number of Howards and Sons, Ltd., has been changed to Ilford 3333. In Howards and Sons' advertisement on the front cover of THE CHEMICAL AGE last week, Plassitil was referred to as a "modern" priced plasticiser; the adjective should have been "moderate."

SHAREHOLDERS OF BRITISH BITUMEN EMULSIONS, LTD., have received an offer to exchange their shares for those of International Bitumen Emulsions, Ltd., on the basis of two International Bitumen shares for each British Bitumen share held. British Bitumen Emulsions, Ltd., which was registered in 1929, is already controlled by International Bitumen Emulsions.

THE ANNUAL DINNER of Johnson Matthey's athletic club was held on January 16 at the First Avenue Hotel, Holborn, and was attended by some 350 members and friends. In the absence of Mr. George Matthey, who sent a telegram of good wishes from abroad, the chair was taken by Mr. T. Girtin, who, in the course of the evening presented the cricket cup to Mr. G. Jones and the tennis cup to Mr. W. Hoppe.

OWING TO LICENSING REGULATIONS, the Institute of Fuel is no longer able to hold its meetings at the British Industries House Club on the same lines as hitherto. Consequently, it has been decided to hold the next informal meeting on January 29, at Gatti's Restaurant. It is not possible for members of the Institute to continue their membership of British Industries House Club during the current year without payment of an independent subscription to that club.

THE TRIPLEX SAFETY GLASS CO., LTD., has issued a circular stating that it is proposed to increase the authorised capital of the company from £200,000 to £500,000 divided into 1,000,000 shares of 10s. each, to alter the articles of association and to issue 400,000 ordinary shares of 10s. each fully paid as bonus shares in the proportion of one share for every share held. Existing shareholders will be offered 100,000 10s. ordinary shares at a premium of £3 per share in the proportion of one share for every four held.

THE ANNUAL SALES CONVENTION AND DINNER of Walworth, Ltd., at which Mr. V. L. Young, managing director, took the chair, was held on January 8, at Bridge House. Walworth salesmen, representatives and departmental heads from the London head office were fully represented. A feature of the gathering was the number of members who have been associated with the company for many years—one for 45 years, one for 43 years, and several others for over 40 years' service. Dinner was followed by a visit to the Saville Theatre.

IN VIEW of the nearness of the British Industries Fair it is important that firms exhibiting new ideas and inventions should realise that the mere fact of the Fair being certified by the Board of Trade to be an industrial exhibition recognised for the purposes of the Patents and Designs Acts does not in itself enable exhibitors to show unprotected inventions without prejudicing their rights therein. It is essential before exhibiting to file a description of an invention in the prescribed form at the Patent Office. Kings Patent Agency, Limited, to whom we are indebted for this information, issue a handbook on Patents and Trade Marks which will be sent free to interested inquirers, and which explains the formalities required.

THE FOLLOWING MESSAGES have been cabled in connection with the Empire Exhibition of South Africa at Johannesburg, which closed on Sunday:—From the Secretary of State for the Dominions to Sir William Clark, High Commissioner in South Africa, for transmission to the chairman of the executive council of the exhibition: "On the occasion of the closing of the Great Empire Exhibition at Johannesburg I should like most heartily to congratulate you and all concerned in its organisation and management on the success which it has achieved." Captain Euan Wallace, secretary of the Department of Overseas Trade to Major Frye, chairman of the executive committee: "I send to you and your colleagues my sincere congratulations on the great Exhibition which is drawing to its close. Only those who, like myself, have actually seen the Exhibition, can fully appreciate the efforts of those responsible for this splendid achievement, which, apart from its educational value and its beneficial effects on Empire trade, has enhanced in the eyes of the world the greatness of the South African nation."

LANARK COUNTY COUNCIL has asked the Scottish National Development Council to consider the re-establishment of the shale oil industry at Tarbrax.

MARINE INSECTICIDES, LTD., 32 Bishopsgate, E.C., have increased their nominal capital by the addition of £1,500 in £1 ordinary shares, beyond the registered capital of £3,500.

THE DIRECTORS of Branston Artificial Silk Co., Ltd., have received an offer to purchase their factory premises at Burton-upon-Trent, excluding rayon plant and machinery, for £160,000, which they have accepted subject to the approval of shareholders. This approval will be sought at a meeting at which the accounts for the year to September 30, 1936, will also be submitted.

THE SECRETARY FOR MINES announces that Norsabite, sheathed with powdered sodium bicarbonate, as manufactured by Northern Sabulite Explosives Co., Ltd., at Haswell, near Sunderland, Co. Durham, has been added to the list of permitted explosives for general use in mines to which Part II of the Explosives in Coal Mines Order applies. Apart from the sheath, this explosive is identical with that of similar name already in the permitted list.

WHEN FIRE BROKE OUT on January 15, at the premises of a firm of chemical manufacturers in Great Pearl Street, Spitafields, several girls working in the third storey were quickly removed to safety. The foreman, in attempting to extinguish the flames, was severely burnt about the arms and was taken to hospital. Several hundred gallons of paraffin, carbolic, and quantities of wax were endangered, but the fire brigade succeeded in isolating the paraffin. The premises were damaged.

THE MANAGING DIRECTOR of the Manchester works of the British Dyestuffs Corporation, convinced that the noise and clatter of the typists' room in the works, which accommodates over 50 machines, must be detrimental to office efficiency and to the comfort of the typists, suggested to visiting experts from the National Institute of Industrial Psychology that the introduction of a number of budgerigars into the room would improve conditions. It was thought that the birds' notes might lessen the fatigue caused by the monotonous noise of the machines. The psychologists agreed that the experiment was worth trying, and a number of birds have been installed in the room.

MORE THAN 3,200 EMPLOYEES of the Shell oil companies are now working a five-day week, following the decision that the London offices of the companies shall remain closed on Saturdays except for a "skeleton" staff. The new arrangement came into force at the beginning of the year. There are about 1,200 employees at Shell-Mex House and 2,000 at St. Helen's Court, E.C., where Asiatic Petroleum Co., Shell Transport and Trading Co., and other subsidiary and distributing companies have their offices. Routine work is not done on Saturdays. The skeleton staff is only to ensure the "continuity of the business." Alternative days off are given as compensation.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Malta.—A small firm of commission agents at Valletta wishes to obtain United Kingdom representation for edible oils. (Ref. No. 659.)

Austria.—An agent established at Vienna wishes to obtain the representation, on a commission basis, of United Kingdom exporters of chemicals (various kinds). (Ref. No. 667.)

Switzerland.—An agent established at Zurich wishes to obtain the representation, on a commission basis, of United Kingdom exporters of heavy chemicals. He already holds the representation of United Kingdom exporters of lead and of nickel alloys. (Ref. No. 671.)

Canada.—A firm of wholesale potato shippers and distributors in Perth is desirous of securing, on a commission basis, the representation for New Brunswick, Nova Scotia and Prince Edward Island of United Kingdom manufacturers of copper sulphate (blue vitriol); monohydrated copper sulphate; and other chemicals used for agricultural purposes. (Ref. No. 657.)

Egypt.—The Commercial Counsellor at Cairo reports that the Department of Public Health, Cairo, is calling for tenders for the supply and delivery of 4,000 bottles (each containing 500 tablets) quinine acid hydrochloride tablets, 5 grains, uncoated; 1,000 bottles (each containing 500 tablets) quinine acid hydrochloride tablets, 2 grains, uncoated. Tenders, endorsed "Tender for Tablets, Quinine Acid," should be addressed to the Director of Stores, Department of Public Health, Cairo, by whom they will be received up to 10 a.m. on February 1, 1937. (Ref. T. 118.)

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

(NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRANDON OILS, LTD., Sheffield. (M., 23/1/37.) January 8, charge to National Provincial Bank, Ltd., securing all moneys due or to become due to the bank; general charge. *£2,000. February 18, 1935.

LADDERIX, LTD., Slough, chemical manufacturers. (M., 23/1/37.) January 6, £5,000 debenture, to G. R. Whitelaw, Putney; general charge.

Satisfactions

BEARCREEK OIL AND SHIPPING CO., LTD., Liverpool. (M.S., 23/1/37.) Satisfaction January 7, of debentures registered October 7, 1908, to extent of £50.

BRITISH CELANESE, LTD., London, W. (M.S., 23/1/37.) Satisfactions January 11, of 1st debenture stock registered August 24, 1922, and July 6, 1923, to extent of £72,862, and of debenture stock registered June 21, 1934, to extent of £46,497.

DORMAN LONG AND CO., LTD., Middlesbrough, steel manufacturers. (M.S., 23/1/37.) Satisfaction January 7, of charge registered March 17, 1933.

SOUTH-EASTERN TAR DISTILLERS, LTD., Tonbridge. (M.S., 23/1/37.) Satisfaction January 8, £750, registered August 20, 1928.

Private Meetings

[Inclusion under this heading does not necessarily imply failure. Many private meetings are called merely for the purpose of the debtor consulting his creditors as to his position when he may not be insolvent.]

KIRK HANCOCK, LTD., Broadfield Road, Sheffield, manufacturing chemists. (P.M., 23/1/37.) The creditors met recently at Sheffield, when a statement of affairs was submitted which showed ranking liabilities of £1,946 14s., and in addition there were fully secured creditors for £186 8s. 2d. After allowing £13 11s. 6d. for preferential claims and £615 due on debentures, the net assets were £317 1s. 9d., or a deficiency, so far as the creditors were concerned, of £1,629 12s. 3d. The assets comprised: stock, £518 5s. 4d., expected to produce £125; fixtures and fittings £23 5s. 9d., valued at £5; office furniture and equipment £28 15s. 11d., put down at £14; book debts £508 13s. 1d., estimated to realise £300; insurance refunds £30; cash at bank £400 16s. 1d.; cash in hand £7 5s. 4d.; and surplus from fully secured creditors £63 11s. 10d. The issued capital of the company was £600, and as regarded the shareholders there was a deficiency of £2,229 12s. 3d. The receiver for the debenture holders reported that he was appointed to act on November 11 last. He had carried on the business for some little time in the hope of effecting a sale as a going concern, but was not successful, and it had been closed down. The principal asset was the cash at bank, which was the amount he had realised up to date. The deficiency was attributed to the losses on trading amounting to approximately £1,300, and the depreciation written off the assets in the statement of affairs. One of the directors stated that the position was brought about by the decline in the sales during the last eight months and to the fact that the goods sold had not been the most profitable. That had had the effect of reducing the gross profit to approximately 10 per cent., whereas previously it had been nearly 33⅓ per cent. All the debentures were issued in respect of a cash consideration. It was decided that the matter should be left in the hands of the receiver until the assets had been realised, and when that was done a decision would be made as to whether the company should go into voluntary liquidation or the surplus utilised in payment of a composition in settlement of the creditors' claims.

Books Received

A Survey of the Present Organisation of Standardisation—National and International. London: Central Office of the World Power Conference. Pp. 55. 3s. 6d.

Water Pollution Research. Summary of Current Literature. Vol. X, No. 1. January, 1937. Abstracts No. 1-114. Department of Scientific and Industrial Research. London: H.M. Stationery Office. Pp. 36. 2s. (obtainable from H.M. Stationery Office).

Company News

Bennis Combustion.—An interim of 5 per cent., less tax, on the ordinary shares, payable February 2 (same), is announced.

English China Clays.—A dividend on preference shares at rate of 7 per cent. per annum, less tax, is announced for the half-year ended December 31, payable February 1.

Benn Brothers, Ltd.—The directors of Benn Brothers, Ltd., proprietors of THE CHEMICAL AGE, have declared the usual dividends, less tax, payable on February 15, viz., 3 per cent. on the preference shares for the half year ended December 31, and interim dividends of 5 per cent. on the ordinary shares and 1s. per share on the deferred shares.

J. and E. Hall.—The report for the year ended September 30 shows, after deducting expenses of management, making ample provision for depreciation and adding £9,378 (£1,261) brought forward, balance of profit of £74,573 (£43,458). The dividend of 8½ per cent. (6 per cent.) on ordinary shares leaves £29,293 forward. This company carries on business as refrigerating engineers.

International Combustion, Ltd.—An increase in profit from £114,800 in 1934-35 to £170,150 in the year ended September 30 last is shown by the accounts. No provision has been made for income-tax in respect of 1935-36, as the directors are satisfied that the existing reserve is adequate. An interim dividend of 7½ per cent. was paid on the ordinary shares in July, and the directors now recommend a final dividend of 12½ per cent. and a cash bonus of 10 per cent., making a total distribution for the year of 30 per cent. After providing for these payments and transferring £50,000 to reserve £24,733 remains to be carried forward, against £25,192 brought into the accounts. Excluding interests in subsidiary companies, floating assets amount to £871,615, compared with current liabilities of £488,712.

Forthcoming Events

LONDON.

Jan. 26.—Royal Institution of Great Britain. "Electrical Conductivity in Solids: Its Dependence on Crystal Structure and Crystal Faults." (continued). Professor N. F. Mott. 5.15 p.m. 21 Albemarle Street, London.

Jan. 27.—Institute of Fuel. "Some Chemical Aspects of the Combustion of Carbon." Professor H. L. Riley. 6 p.m. Meeting room of the Chemical Society, Burlington House, Piccadilly, London.

Jan. 28.—Mineralogical Society. General Meeting. 5 p.m. Rooms of the Geological Society, Burlington House, Piccadilly, London.

Jan. 29.—Institute of Fuel. Informal meeting. Discussion on "National Oil Storge," opened by H. Moore. 6.30 p.m. Gatti's Restaurant, 436 Strand, London.

Jan. 29.—Royal Institution of Great Britain. "Recent Crystallography." Sir William Bragg. 9 p.m. 21 Albemarle Street, London.

BIRMINGHAM.

Jan. 25.—Society of Chemical Industry (Birmingham Section) and Birmingham University Chemical Society. "Chemistry and Immunology." Dr. M. Stacey. 5 p.m. Chemical Lecture Theatre, Edgbaston, Birmingham.

Jan. 29.—Institute of Metals (Birmingham Section). "Special Cast Irons." J. G. Pearce. 7 p.m. James Watt Memorial Institute, Birmingham.

LEEDS.

Jan. 28.—Chemical Society (Leeds Section). "Silicates." Professor W. L. Bragg. Leeds.

LIVERPOOL.

Jan. 27.—British Association of Chemists (Liverpool Section). Section meeting. 7.30 p.m. Victoria Hotel, Liverpool.

Jan. 29.—Chemical Society (Liverpool Section). "Sesquiterpene Ketones, their Structure and Synthesis." Professor J. L. Simonsen. 6 p.m. Chemistry Lecture Theatre, The University, Liverpool.

MANCHESTER.

Jan. 29.—Institution of the Rubber Industry (Manchester Section). Annual dinner-dance. Manchester.

Jan. 20.—British Association of Chemists (Manchester Section). Conversazione. 7.15 p.m. Engineers' Club, 17 Albert Square, Manchester.

NEWCASTLE-UPON-TYNE.

Jan. 28.—Institute of Chemistry and Society of Chemical Industry (Newcastle and North East Coast Sections). "Colloids." Professor H. L. Riley. Newcastle-upon-Tyne.

SWANSEA.

Jan. 29.—Chemical Society (South Wales Section) and University College of Swansea Chemical Society. "Recent Progress in Inorganic Chemistry." Dr. W. Wardlow. 6 p.m. Department of Chemistry, University College, Swansea.

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